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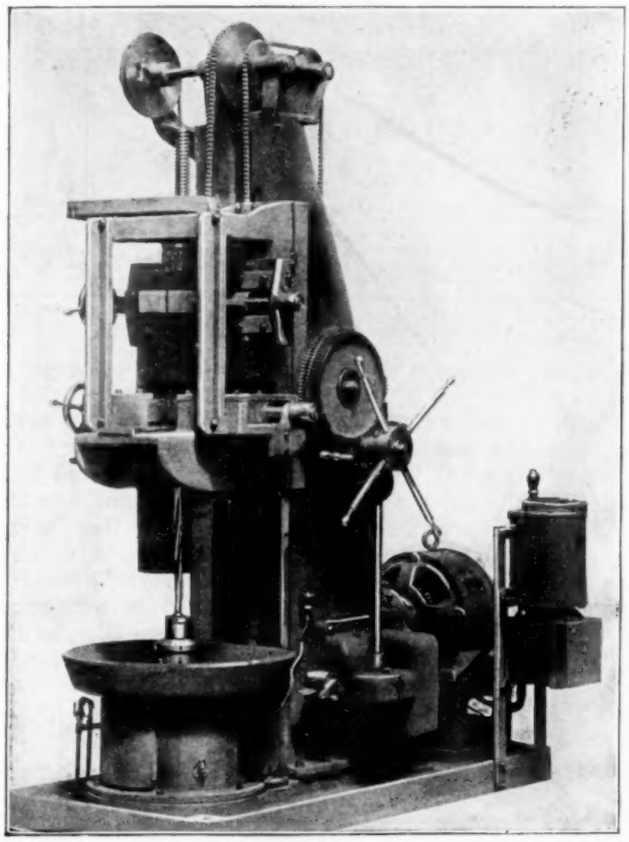
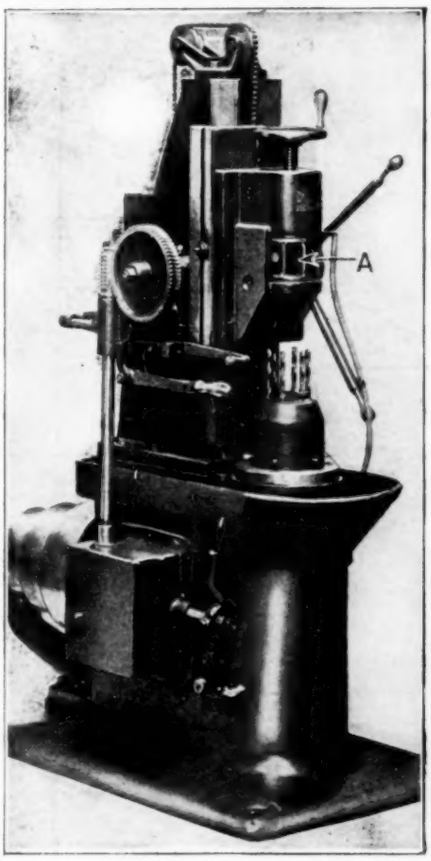


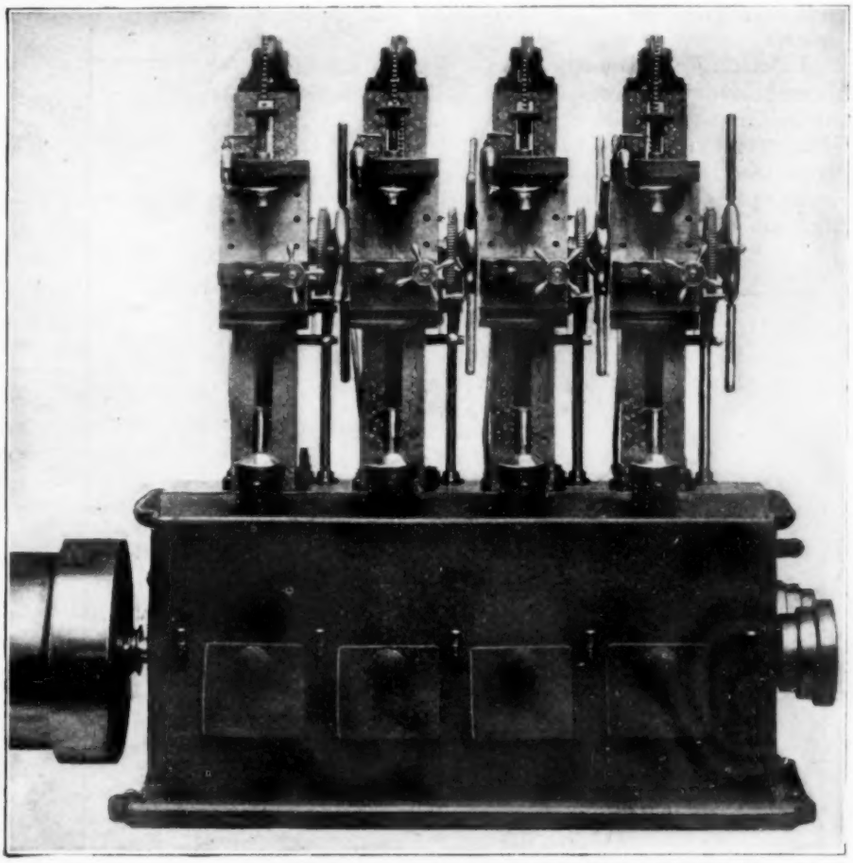
The Foote-Burt Inverted Drilling Machines

By J. V. HUNTER
Western Editor, *American Machinist*

The inversion of the spindles of a drilling machine is so unusual a feature that one is impelled to notice such a machine when found in any manufacturing plant. A considerable number of such machines are in use but the majority have been built for special purposes, and therefore are not found in the general run of shops. A number of types of machines of this character are described in this article.

THE drilling machine is built with inverted spindles for three reasons: First, for deep-hole drilling, since the inverted spindle greatly facilitates the clearance of the chips from the drill and avoids constant withdrawal of the latter to remove chip accumulations; second, for handling pieces that can be drilled in a standard machine only with great inconvenience; third, as a result of modern manufacturing methods where the bases of heavy castings, which pass through the shop on long transveyors, are to be drilled and it is desirable to use inverted drilling





FIGS. 1 TO 3. SINGLE-SPINDLE, MULTI-SPINDLE, AND GANG-TYPE INVERTED DRILLING MACHINES

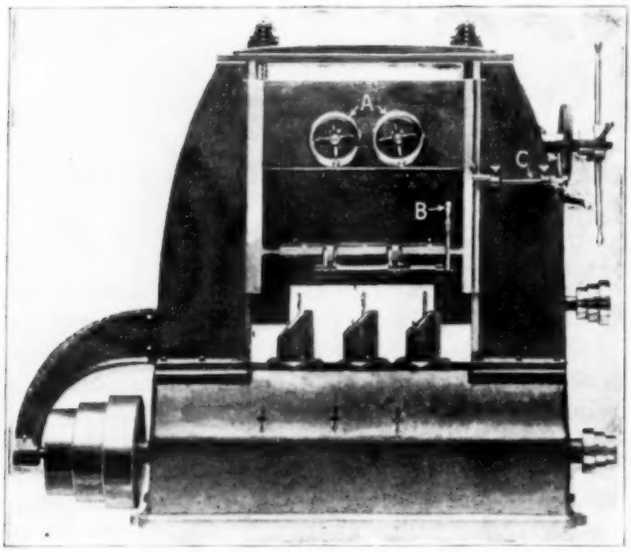


FIG. 4. DOUBLE-COLUMN MACHINE FOR HEAVY AUTOMOBILE WORK

methods to avoid rolling over for drilling. This latter reason is actually closely bound up with the second reason and in some cases it is hard to make a distinction between them.

The Foote-Burt Co., Cleveland, Ohio, has been building a line of inverted drilling machines to meet all of these conditions and from the nature of its work, the majority are special in design to meet the engineering requirements of the job. One of the main difficulties in inverted drilling has been caused by dirt and chips which work into the spindle bearings, but this trouble has been eliminated in a way which will be described later.

In taking up the study of inverted machines for deep-hole drilling, possibly no better example can be found than that shown in Fig. 1. This machine was built for drilling a 1¼-in. hole, 30 in. deep, through a tool-steel billet.

In operation the billet is lowered by a crane through the top of the work-holding cage and is clamped centrally in position by hand-operated vise jaws. A swinging door at the top of the frame carries a heavy pressure screw which is brought down against the billet to take the end-thrust of the drill. The spindle on this machine has no vertical movement and the feed is obtained by lowering the work-holding fixture, which is mounted on a saddle sliding on the vertical ways of the column. Counterweights are used to compensate for the weight of these moving parts. An oil-tube drill is used and coolant which is contained in a reservoir

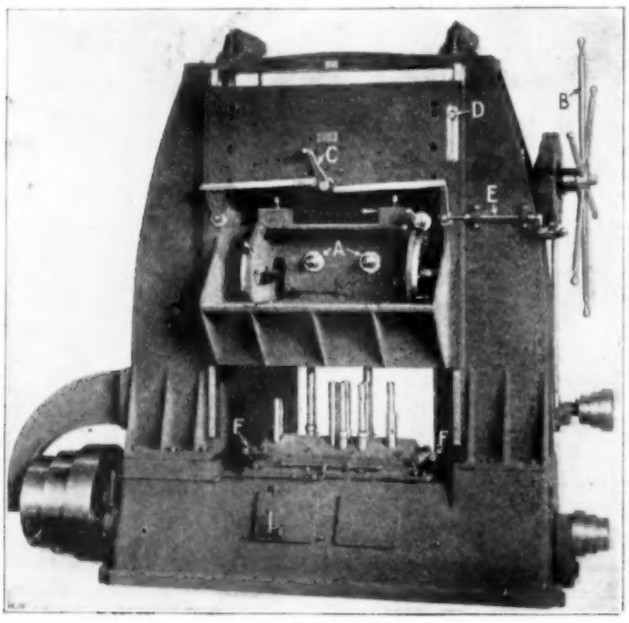


FIG. 5. MACHINE FOR DEEP DRILLING IN AN ENGINE BLOCK

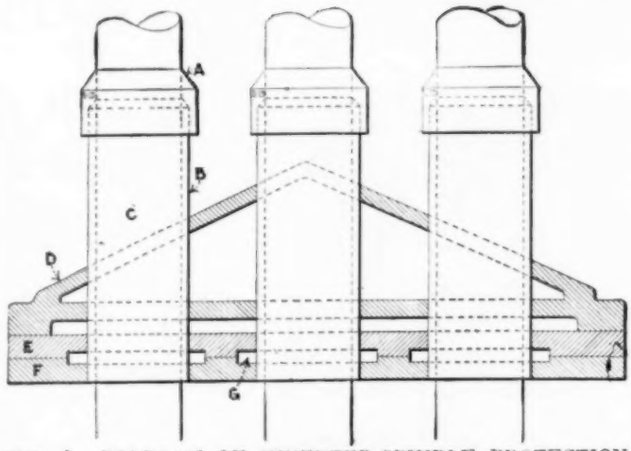


FIG. 6. DIAGRAM OF INVERTED-SPINDLE PROTECTION AGAINST DUST

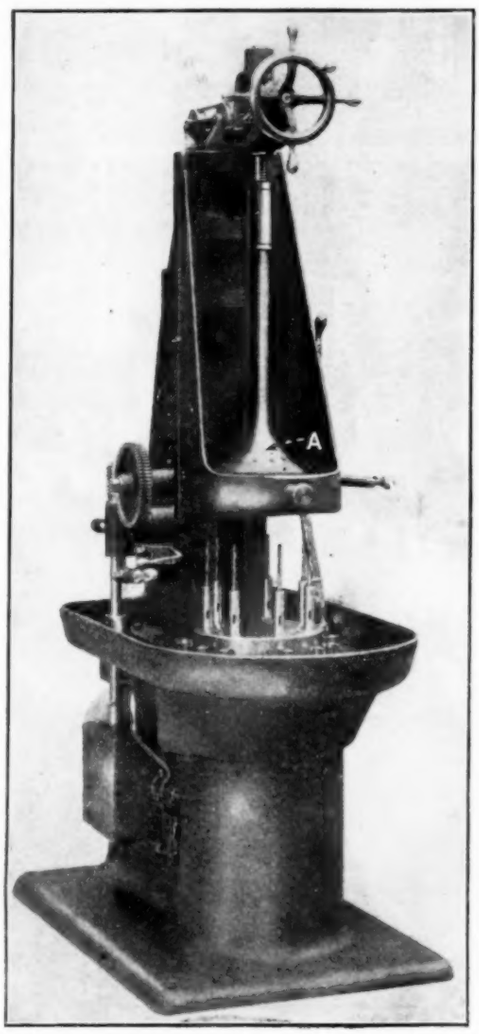


FIG. 7. DRILLING REAR-AXLE HOUSING FOR CONVENIENT HANDLING

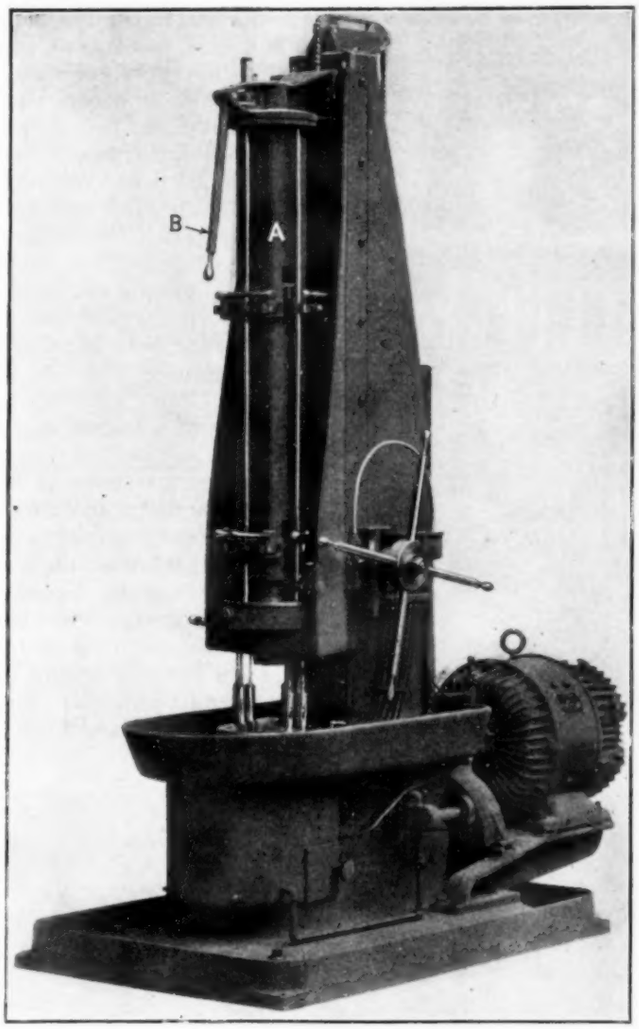


FIG. 8. SPECIAL CONSTRUCTION FOR DRILLING STEERING RODS

in the base is fed constantly by a pump to the cutting point of the drill.

These machines are also built in multi-spindle and gang type as shown in Figs. 2 and 3. The work fixture heads are counterbalanced and may be easily raised. Power feed is provided for drilling.

A Two-Column Machine

A machine with two columns between which slides a heavy carriage carrying the work, is shown in Fig. 4. The two handwheels *A* on the upper side of the carriage together with the lever *B* near its bottom are provided for locking the work in place. The three peculiar-shaped thimbles on the base of the machine each carry two drills, the larger for a deep and the smaller for a shallow hole. On the right-hand column is a knockout *C* for the feed.

Another double-column machine, Fig. 5, was built for drilling several oil holes in an automobile-engine cylinder block. These are $\frac{19}{32}$-in. holes drilled to a depth of 8 in. The casting while lying on its side is slid into the jig, and after locking it into place the jig is rotated 90 deg. to bring the side now showing the drill bushings into correct relation with the spindles. The saddle is counterweighted so that the operator can readily raise it by the spoke wheel *B* on the right-hand column, and lock it in the raised position by a device controlled by the lever *C*. Power feed is provided for a travel of 13½ in. and has an automatic knockout when the adjustment stop *D* comes in contact with the tripping device *E*.

This illustration shows more clearly the dirt and chip protection device for the spindles than do the others, and this is further detailed in the sectional view, Fig. 6. Attached to the spindle is a cone *A* which comes down over the sleeve *B* surrounding the spindle *C*. The sleeve extends through the sloping cover *D* which is designed to throw off the chips without constant brushing by the operator. Below this cover are two plates *E* and *F* with connected dust pockets *G* cut in them. The plates fit tightly about the spindles and are bolted together on the spacing rim at their outer edges so as to make the dust pockets *G* practically air-tight. At the ends of the covering device will be seen hose connections *F*, Fig. 5, to one of which an air hose is connected and all dirt which collects in the dust space is blown out through the other opening. This protection has been found to insure the spindle bearings and gears against damage from the fine dirt and grit which ordinarily will work its way through the smallest openings.

Drilling machines of the inverted type built for convenience in handling the work can be shown by numerous examples which demonstrate the value of this design. A machine, Fig. 7, for drilling the rear-axle housing of a well-known automobile illustrates the advantage of having this part rest on its large end *A* while being drilled. A pressure screw at the top of the

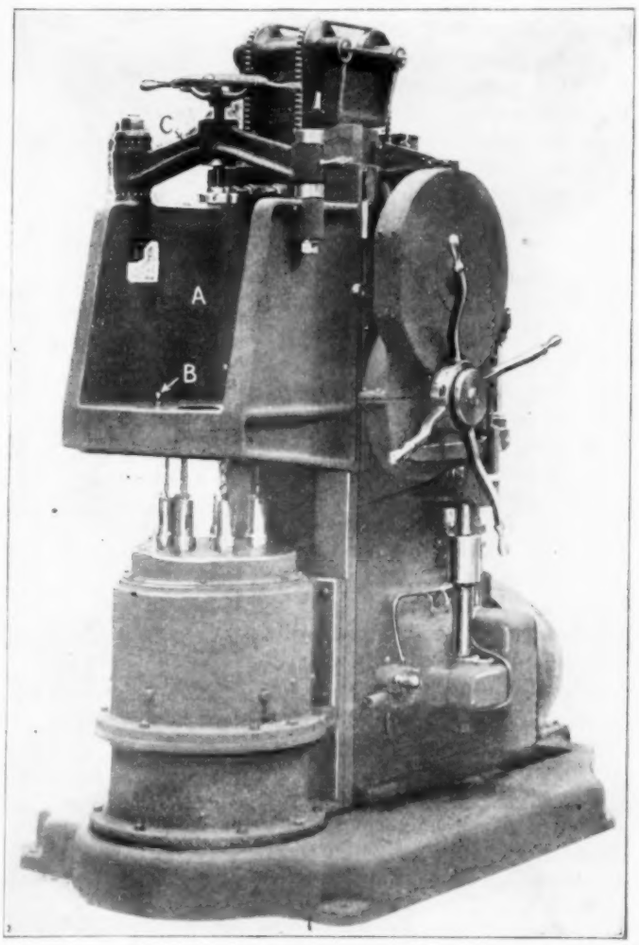


FIG. 9. MACHINE FOR INVERTED DRILLING OF AIR-BRAKE RESERVOIR CYLINDER

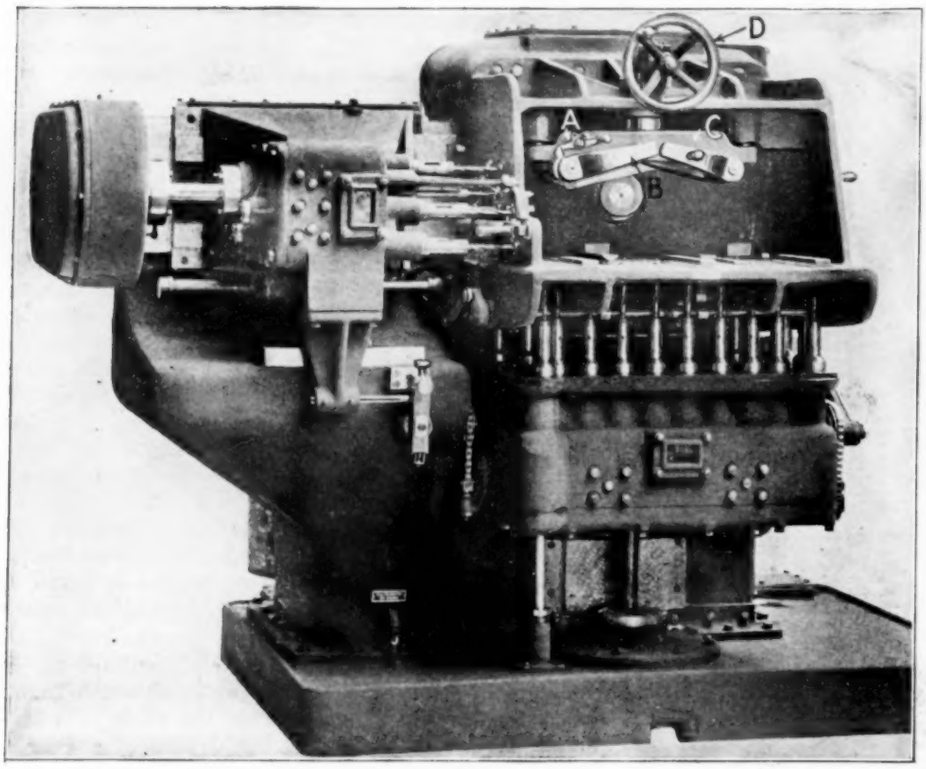


FIG. 10. TWO-WAY DRILLING MACHINE FOR CRANKCASE OF TRACTOR ENGINE

work carriage provides the only clamping necessary to hold the work firmly against the jig plate.

This same automobile has a steering rod with a flange on its upper end in which three holes are drilled and reamed by the machine shown in Fig. 8. This machine performs three separate functions and to do this it is provided with the jig *A* with trunnions at each end, about which it is revolved by releasing the locking lever *B*. There are nine spindles arranged in groups of three. The first spots for the drills, the second drills and the third reams the holes. While the jig head is feeding the three loaded sides to the tools the operator is loading the fourth side and he has only time to complete this while the machining is in progress and then revolves the jig 90 deg. and repeats the operation.

The machine illustrated in Fig. 9 shows from another viewpoint of the great convenience in handling which may be obtained by the inverted method. This was built for drilling the flanges of an air brake reservoir cylinder, that has an off-center lug on the opposite end from the flange to be drilled, and this together with its heavy weight made it very difficult to handle under an upright drill. It is dropped into the heavy frame *A*, with its machined flange resting on the jig plate and positioned by the pin *B*. The clamping yoke *C* is swung out of the way while placing the casting, and is then replaced and the screw turned down to clamp it.

The machine, Fig. 10, was designed for drilling the crankcase of a tractor engine. The parts are carried through the shop on a transveyor with their faces down and time is saved by not having to roll them over; while at the same time they can be jigged to greater advantage when resting on this machined surface. This is a two-way drilling machine and embodies many features which cannot be described here but the most

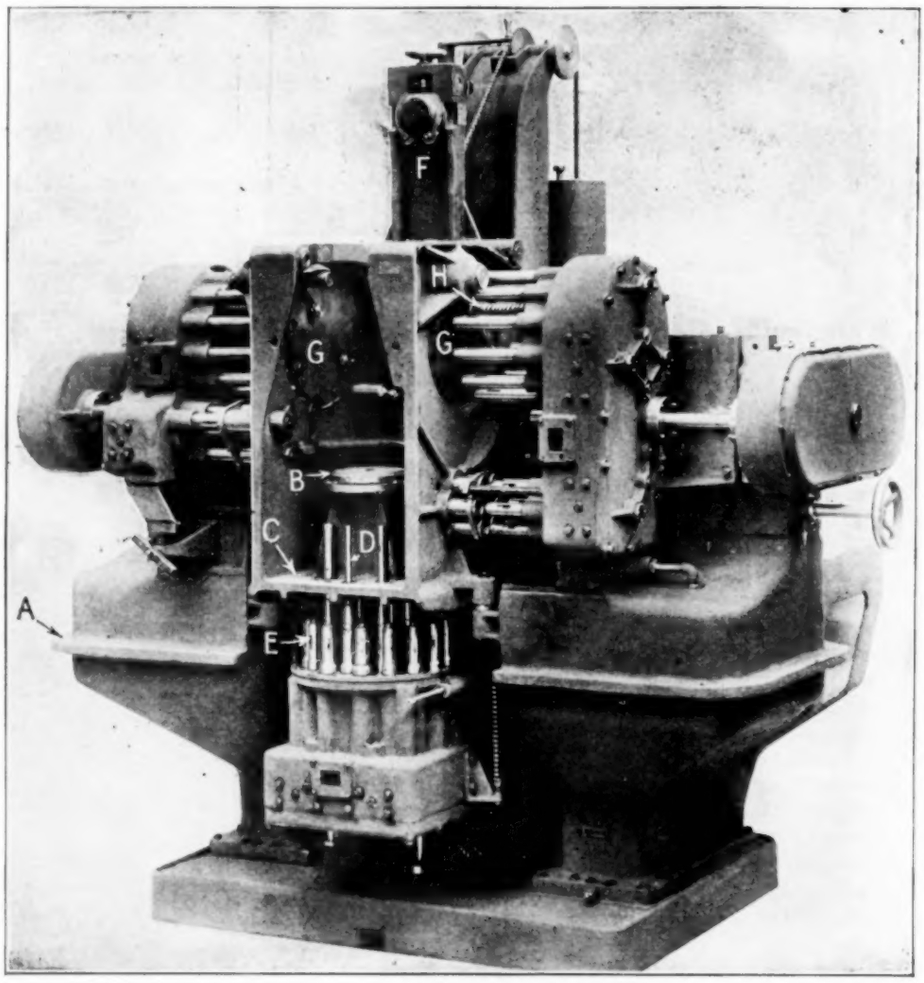


FIG. 11. THREE-WAY DRILLING MACHINE FOR TRACTOR AXLE HOUSING

radical difference between this and the preceding machines lies in the feed methods which are obtained by travel of the spindle heads toward the work. The clamping arrangement is unusual and yet simple in design. Releasing the trigger *A* permits the four interlocked arms *B* to fall into a perpendicular position resting on the flanges of the casting. They are fastened to a main head *C* and this is forced down with sufficient pressure by a screw operated by the handwheel *D*.

The size of the machine shown in Fig. 11 can be judged from the fact that the ledge *A* is the actual floor line, and all below this point is placed in a pit so as to lower the machine to a point where the operator can reach the working mechanism. This was built for drilling the transmission-housing castings of the Fordson tractor, which are conveyed through the shop standing on their open bell-shaped ends, and at this machine are lifted by a hoist and swung into the frame of the fixture.

When lowered into place, the casting goes over the centering plate *B* until its flanged end rests on the jig plate *C*. Both of these plates serve to guide drills to different sections of the casting, the plate *B* guiding drills carried in the long spindles *D* while plate *C* guides the drills carried in the short spindles *E*. The work is held in place by lowering the hinged plate *F* into a horizontal position. Another feature of this machine is the sliding jig plates *G* carried on large pins; these are forced into contact with the work when the side spindle heads advance and are pulled back when the pressure on the springs *H* is relieved by the withdrawal of the heads. This avoids interference of these heavy plates with the placing or removal of the work pieces.

Extracts From Chordal's Letters

In this letter Chordal tells of the progress in the practice of architecture in later years and how, when one material is substituted for another, the designs remain the same for some time. He also tells some things about interchangeable work and how certain implements of precision were made at the same cost as those of a lower grade. From this letter it is evident that Chordal anticipated the use of the present photostat many years in advance.

Mr. Editor:

* * * A column is a vertical support and it is a straight sort of an affair, no matter what it is made of, whether of iron, or wood, or stone, or brick, and an arch is an arch whether it be of cast iron, or of stone, or of brick, or of wood. Whether or not these things shall be made ornamental is a question of fancy. I believe it was Ruskin who said all architecture was the ornamentation of the building and that the architect was not concerned with its convenience or its adaptation to its purpose or to the methods of its construction. Our modern architect is truly the all-round man, if there is an all-round man, and at the very start he deals with convenience and adaptability to purpose, and with materials and method of construction, and, last of all, he deals with ornamentation of form or surface. In other words, he plans his structure and deals last with the question of how the eye will be affected.

* * * When a given art, appealing to the eye, has been for a lifetime dealing with a certain material, then if the art changes to a new material the old forms are very often adhered to. Take, for instance, a railway passenger car or sleeping car. These used to be of wood and certain features of their interior architecture were of a form enforced by wooden construction. Then the arts switched to the steel car, and when we enter a steel sleeper we want to knock on something to find out whether we are in a wooden or a steel car. Every detail we find to be strongly imitative of wood, indeed, the surfaces are imitative, and the wall of sheet steel appears as mahogany. The time will probably come, in the course of an age, when the interior of a steel passenger car will look as though it were made of metal and the interior of a wooden passenger car will look as though it were made of wood.

* * * In modern days, steel furniture is taking the place of wooden office furniture and, in making the change, the same lines are followed. If we see a steel office desk the chances are that it looks so much like a wooden desk that we can hardly tell the difference, and the question is, should there be any difference in form or in detail, understanding, of course, that there is a fundamental form based on utility, and that ornamentation is an entirely different matter. If you have an office safe built of steel it has a certain form and appearance. You use it for purposes of safety and it looks safe. Now, if you no longer have use for the safe as a safeguard but still desire it as a mere container and build it of wood, what is to be said if the wooden safe, so to call it, is built exactly along the lines of the metallic safe, even to the size and character of the hinges, and the dial and knob of the combination lock.

* * * The late war, and by the way, "late war" means something entirely different from what it meant many years ago, has developed certain lines of manufacturing which are interesting. Uncle Sam would want, say, a thousand cannon and he would parcel out the making of them to hundreds of different concerns, one establishment to make the guns, another the recoil mechanism of the guns, another the carriages, another the wheels for the carriages, another the sighting instruments, and so on through the entire list. When these different establishments delivered their individual products they had to fit in place on the products of other establishments. And here is where the system of well-studied tolerances and close inspection came into play.

Many of these contracts were let to manufacturing establishments who had or were willing to get the proper facilities but were totally unacquainted with the system of interchangeability, and now that the war is over it is believed that something good will be left from the Government-enforced system of inspection. In war work interchangeability is essential and it has gotten down in late years to a satisfactory point. I believe I am safe in saying that if all the rifles and all the field guns and all the wagons which we sent over to France should have been there dismantled and a mixed pile made of their separated elements, those elements could have been picked out at random and put together all right.

* * * Interchangeability is after all merely a case of well-studied tolerances and rigid inspection. Some years ago I remember seeing in the *American Machinist* a picture of a couple of square bars, about an inch square and four inches long, doweled together with two pins, one of these bars having two holes which had a sliding fit on the pins projecting from the other bar. Now, that pair of bars with its pins was a thing anybody could make by simply putting the two bars together and drilling the holes through the bars while they were together, and then making the pins to have a driving fit in one bar and a slipping fit in the other bar.

* * * But the point is this, the article illustrated in the *American Machinist* had its parts made in two different shops a thousand miles apart, and when they were brought together they fit each other. I believe this to have been the most readily acceptable example that I have ever come across illustrating the idea of interchangeability in machine manufacture. It was simple enough and complicated enough to set in motion the entire train of thought on the subject of interchangeability.

* * * In resuming my letters to you I ventured the thought that blueprints had been invented since my earlier series of letters ceased. I suggest, Mr. Editor, that you start a little research into this matter and let us know something about the early history of the blueprint.

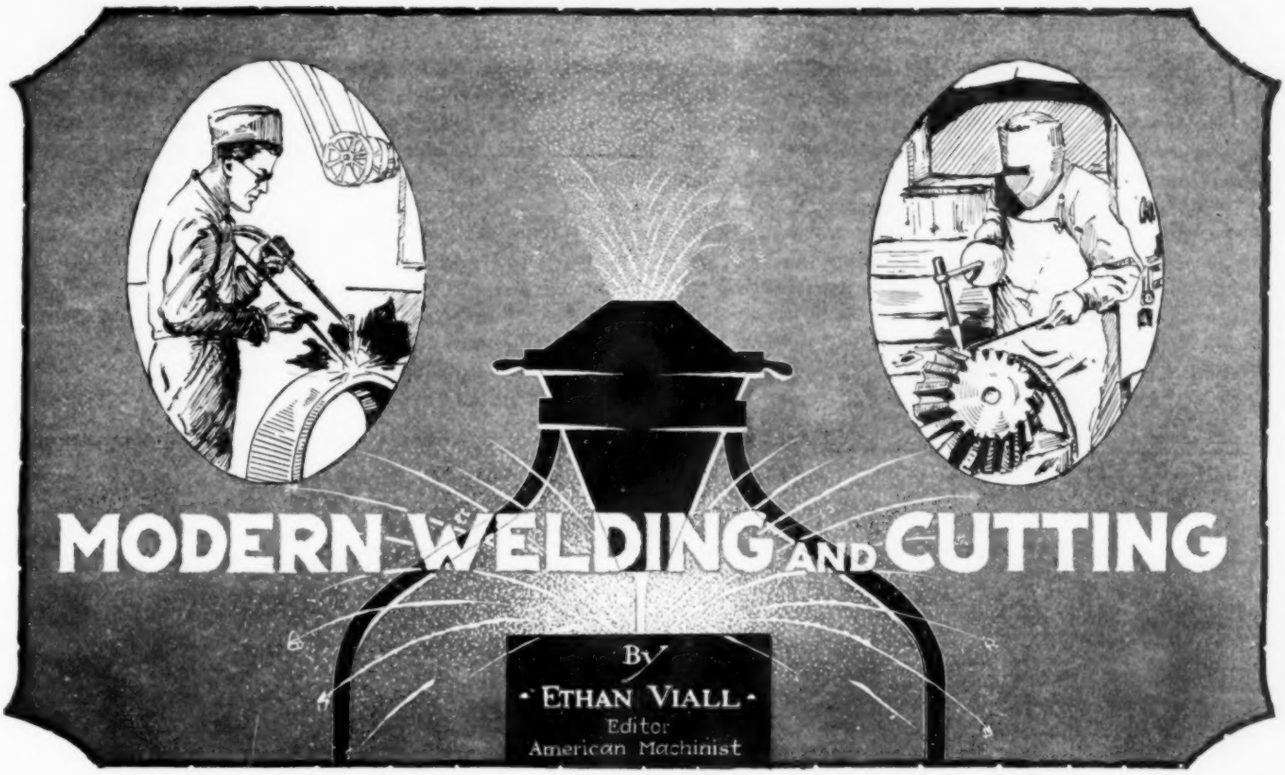
* * * A business that I was once in, required that I send out lots of little drawings. At the start I would make a drawing and then have it photographed and would send out the photographs. Later, I adopted the plan of making the drawings in the form of tracings which I would send to the photographer and he would use the tracings as negatives to print the drawings from. The process was slow and expensive.

* * * As an illustration of how an ignorant inventor's mind works I can cite myself as an example along this line. It struck me that the ideal thing would be a photograph which could be made directly on sensitive paper. My main thought was the copying of documents, as in record books, and I went so far as to get a patent on a record book on whose leaves were pasted photographs of documents, the seal of the recorder's office being impressed partly on the book-leaf and partly on the photograph. This was on the idea that the photograph could be made directly on paper without bothering with the negative. Then I did something which I ought to have done in the first place. I consulted experts in photography and they quickly threw cold water on my scheme by informing me that you could not make a photograph directly on paper without a negative. I could not dispute these experts, though I could not see why a direct photograph could not be made on a sheet of sensitive paper as well as on a sensitive copper plate in daguerreotyping. This was many years ago and now we have the photostat, a machine on the camera order for use in the office or drawing room and it is a complete photographic outfit in itself, and can be run by a boy. In the machine are inclosed a roll of paper and certain accessories and there is a front tube looking down on a table-like support. You put your drawing on this table, and make the exposure, and turn the crank, and out comes the copy, needing only to be dried. I believe five minutes covers the process. If you write a letter to a man and would like to send him an illustrated page from some book, you lay the book open on the table of the photostat and, presto, in a few minutes you have a photographic copy of the page, full size or reduced, to send along with your letter. You have an inquiry from some one who wants a repair part for some machine, but his description is somewhat lame and leaves you more or less in the dark. You find two castings, either of which may be the thing he wants, and you lay them on the table of the photostat and in a few minutes you are able, in answering his letter, to inclose photographs enabling him to make his choice.

* * * Your associate, Mr. Hand, has been kind enough to say to me that some of the old readers of the *American Machinist* have an interest in Chordal and that he believes that this interest would justify some biographical notes which might prove interesting. I have studied over this matter somewhat and am inclined to start in on the subject, so you may reasonably expect in the near future to receive something along this line.

* * * Speaking of Mr. Hand reminds me that years ago he was a member of the firm of Richards, Hand & Taylor, of Philadelphia, manufacturers of gaging and measuring instruments. I remember visiting their shop at one time and watching their processes, and getting their price list. As I recollect it, they had three grades of accuracy in their gaging implements. An outside caliper, for instance, of a certain size, with a guaranteed accuracy of one five-thousandth of an inch, would be priced at so much; with a guaranteed accuracy of one ten-thousandth of an inch, the price would be a trifle higher, and with a guaranteed accuracy of one twenty-five-thousandth of an inch, the price would be a trifle still higher. I was talking with a manufacturer in a similar line and he ridiculed this price list saying that the cost would be many times higher for the high limit of accuracy than for the low limit. Now, while I said nothing to this manufacturer on the subject, I happened to know that the gages made by the Philadelphia concern all cost the same regardless of the degree of accuracy, it being simply a question of measuring everything with accuracy and laying them in three piles and putting the highest price on the pole of highest accuracy.

* * * And this reminds me, without any reason of connection, of the process of "sealing" followed by the manufacturers of weighing scales. If a scale maker builds, say, a platform scale, he tests its accuracy as a whole, and corrects for errors somewhere in the mechanism. Another plan is to "seal" each individual element before the parts are put together, the idea being that if each element is right the whole organization must be right. Very respectfully, CHORDAL.



XVIII—Welding Various Metals and the Fluxes Used*

Before dealing directly with the use of fluxes, it is advisable to go back over some of the ground already covered. It must be borne in mind that in order for a welder to intelligently handle the work placed before him he must be able to immediately establish the identity of the metal, recognize its properties, have knowledge of its behavior under the welding flame, and know exactly what treatment to give it. This necessary knowledge cannot be acquired within a short time. It will result only from experience, careful observation, and close examination during welding.

(*The last installment appeared on page 685, Vol. 51.*)

THE first property to be considered in welding various metals is the melting point. Gas-torch welding is the joining together of two metal parts by fusion at the line of contact and in order to secure a perfect weld it is necessary that each part be melted, and the molten metal allowed to flow together and harden in this state of mixture.

The approximate melting points and other properties of the metals and alloys commonly welded are given in Table XXII, taken from "Oxwelding and Cutting."

When metallic bodies are subjected to an increase in temperature they expand, the rate of this expansion being closely known for each degree of rise in temperature. When the temperature is lowered a reverse action takes place, the bodies contract and the volume and linear dimensions decrease. This has been explained to some extent in a previous chapter, and examples given to show the effects. Each metal has its own coefficient of expansion, which varies materially for the different metals. As seen from the table given, of the metals most commonly welded aluminum expands the most, bronze and brass next, then copper, steel, and iron. Aluminum expands almost twice as much as iron or steel.

Conductivity and Oxidation

The conductivity of a metal is its property of transmitting heat throughout its mass. This property is not the same for all metals, and varies widely. It is commonly called thermal conductivity.

It can be seen that if one metal conducts or transmits the heat from the torch flame more rapidly than another, it is necessary that allowance be made as to the method of handling the job, the size of the torch, and the nature of the preheating equipment used.

In welding metals of high thermal conductivity it is necessary to use oversize tips—as in the case of copper where the melting point is low and the conductivity high. However, too large a flame is bad, because the operator will not be able to correctly place the mass of molten metal. On sheet work the proper flame will melt the metal to a width about equal to the thickness of the sheet.

When welding heavy work the operator should be very careful not to blow a part of the molten metal on to colder portions as it will make a defective weld at that point (called an "adhesion"). If this should occur, the flame should be played over this chilled portion until it is in fusion with the molten metal.

Certain metals oxidize more rapidly than others. Oxidation is the reaction produced by the combination of oxygen with a metal. The weld may become oxidized by contact with the oxygen in the air and by the presence of excess oxygen in the welding flame. An oxide has none of the metallic properties of the metal from which it is formed. When present in a

*For the author's forthcoming book, "Welding and Cutting."
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weld it seriously weakens it and it is therefore very necessary that it be avoided as far as possible.

Some oxides are lighter than the metal itself, while others are heavier. Consequently, when a metal is reduced to a molten condition the oxide will either float on the surface of the liquid metal, remain suspended, or tend to sink toward the bottom.

The melting point of oxides is in some cases higher, and in others lower, than that of the original metals. This point must also be considered in attempting to eliminate oxide from a weld.

Some metals when molten also have the property of dissolving a portion of the oxide, the extent of this solution being dependent upon the metal itself. When this is the case the oxide is retained in solution until the metal hardens, in some cases separating and producing a weakened weld, in others being retained permanently.

Oxide may be dealt with in two ways. First, by taking means to prevent its formation, by the use of a neutral or reducing flame in the torch, or by the use of various cleaning fluxes; second, by eliminating the oxide after its formation with suitable fluxes, which either dissolve or float it off, or by mechanically removing it by the manipulation of the welding rod or a paddle made for this purpose.

The subject of oxidation is one of vital importance to the welder, one that he should study thoroughly in order to become familiar with all its forms. Oxidation is the cause of a great majority of defective welds.

There are also metals, that, when heated to the melting point, have the property of absorbing gases from the flame. When the metals cool, the gases are released. In a great many cases the release of the gases occurs at a time when the metal is not sufficiently fluid to allow them to pass to the air. Consequently, small bubbles or blowholes are incorporated in the weld. Then, too, in the welding of various metals the force of the torch flame causes the molten metal to flow back away from it. When the flame is withdrawn the molten metal returns—similar to the action of any other liquid. At such times the return of the molten metal may be so rapid that small quantities of the gases become entrapped and remain in the weld as blowholes. This is a very common occurrence in cast-iron welding.

In the case of the absorption of the gases by the hot and molten metal, the difficulties may be overcome by the use of proper protecting and cleaning fluxes and properly prepared welding rods.

In the case of the gases being entrapped by the molten metal, this may be overcome by "working out" the gas by means of the torch and welding rod.

TABLE XXII. PROPERTIES OF METALS COMMONLY WELDED

Metals	Weight Lb. Per Cu. In.	Tensile Strength Lb. Per Sq. In.	Coefficient of Linear Expansion Per Degree F	Specific Heat	Melting Point Degree F.	Relative Heat Conductivity Copper W1.00	Latent Heat of Fusion B.T.U's per Lb.
Cast	.0924	12000–14000	.0000123	.2185	1215	.504	180
ALUMINUM							
Drawn	.0967	25000–55000	.0000136				
Cast		18000–20000					
BRASS	Cu–60 Zn–40 .3036		00000957	.0939	1740	.204	
Drawn		40000–78000					
BRONZE	Cu–90 Sn–10 .3132	36000	.00000986		1650–1750	.735	
Cast		24000					
COPPER	.3186		.0000093	.09515	1982	1	77.9
Drawn		30000–60000					
White Cast		13000–22000			1922–2075		43.4
IRON	.2840			.1138		.152	124.2
Grey Cast		18000–29000	.00000556		2228–2786		59.4
WROUGHT IRON	.2779	50000–90000	.00000648	.1138	2732–2912	.156	
LEAD	.4108	1720–2050	.0000162	.0314	621	.076–083	9.66
NICKEL	.3179	54000	.0000071	.1086	2645 5	.14	122.4
Cast	.2479						
ZINC		5000–7000	.0000161	.0955	786	.303	40.6
Rolled	.2598						
Mild	.2834	55000	.0000063	.1165	.2687	.139	
STEEL							36
Hard		78000		.1175	.2370		

The Oxweld Co.

Vaporization of Substances

In the manufacture of metals substances are combined in amounts which determine the behavior and characteristics of the metal. In iron and steel there is a certain amount of carbon, silicon, manganese, phosphorus, sulphur, etc. While these substances may be present in only very small quantities, yet their elimination, or presence in excess, may materially affect the mechanical properties of the metal.

The high temperature of the welding flame may cause these substances to burn out or to volatilize. They can burn or oxidize directly in the oxygen of the atmosphere, in excess oxygen in the welding flame, or by the reduction of the oxide of the metal formed in melting.

In the working of brasses, bronzes, or any alloy in which zinc is present, it is commonly observed that the zinc vaporizes and passes off as heavy white fumes in the form of zinc oxide. It can be seen that when this occurs the zinc content of the alloy is materially reduced, and consequently the resultant weld will not

have the same mechanical and chemical properties as the original metal. Special fluxes are provided to prevent this; also, welding rods can be obtained which will either prevent the vaporization of the volatile substance or will replace it.

Separation of Elements

Alloys are uniform mixtures of metals. The fusion of the different elements composing an alloy is carried out at a certain fixed temperature. In the welding of metals of different kinds, it has been noted that when some of these alloys have been heated to the high temperatures produced by the welding flame various substances separate or segregate and that it is impossible to secure a uniform weld.

This segregation occurs quite frequently under the torch flame and also occurs in the manufacture of the metal. Under these conditions the difficulty of welding some alloys can be readily seen.

Welding Various Metals

With the foregoing facts and suggestions in mind we will now take up the various metals most frequently welded, and give directions that will apply in their special cases. The composition of various fluxes will also be given, but it should be remembered that the different accessory concerns can supply far more satisfactory fluxes than can be made in small lots by the individual user, and the welder should, where possible, buy the fluxes needed and apply them according to directions. This also applies to welding rods which should be bought from reliable concerns for certain specified jobs. For emergency work, where the proper rods are not available scrap material or wire may be used, but it is not good practice. A first-class welder who cares for his work and his reputation will use rods of the proper chemical composition for the work he has to do. For this purpose he should buy his rods from firms of established reputation, who are not afraid to advertise their output.

Welding Aluminum

Aluminum parts to be welded may be divided into two classes—those made of drawn or rolled aluminum and those which are cast.

Rolled aluminum is usually 98 per cent. pure or better, the main impurities being silicon and iron. Aluminum as pure as this is seldom used for castings, since its strength is considerably less than that of various alloys. Zinc in amounts ranging from 5 to 25 per cent. but usually about 10 per cent., was often used in the past, but the alloy was so brittle just below solidification that a large number of castings were defective owing to shrinkage cracks. A copper alloy is now more commonly used, the copper content being less than 15 per cent., 7 per cent. probably being the favorite. This is not so strong at ordinary temperatures as the zinc alloy, but it does not have such a tendency to crack. This makes it much better for welding as well as for casting, especially on complicated work.

Aluminum oxidizes easily in the air, especially at high temperatures, and in the latter condition the oxide coating is quite thick. This oxide melts at a much higher temperature (5000 deg. F.) than aluminum (1215 deg. F.) and as the oxide is of greater specific gravity (heavier) than molten aluminum, it will sink down into the metal when welding unless it is removed in some way. As the oxide is very resistant to the action of any acid or alkali, even at a high temperature, any flux used must of necessity be drastic in action and if carelessly used, exceedingly injurious to the aluminum weld. On this account any flux should be used with caution and any surplus removed as soon as possible.

A flux is generally used in welding sheet aluminum where the puddling method cannot well be employed. More divergence must be allowed than for iron. Fluxes are usually composed of alkaline fluorides, chlorides or other combinations as shown in Table XXIII. However, these and other flux mixtures are only given for reference purposes, and it cannot be too strongly urged that all welders buy the fluxes used and follow directions in each case.

TABLE XXIII—FLUXES FOR WELDING ALUMINUM

	Formula Numbers						
	1	2	3	4	5	6	7*
Chemicals	%	%	%	%	%	%	%
Sodium Chloride	30.	....	12.5	16.	17.	6.5	30.
Potassium Chloride	45.	33.3	62.7	79.	83.	56.	45.
Lithium Chloride	15.	33.3	20.8	...	...	23.5	15.
Sodium Flouride	...	33.3	....	...	...	....	...
Potassium Flouride	7.	....	....	...	...	....	7.
Sodium Bisulphate	3.	....	....	...	...	....	...
Potassium Bisulphate	...	....	4.	...	...	....	3.
Sodium Sulphate	...	....	....	...	...	4.	...
Potassium Sulphate	...	....	....	5.	...	....	...
Aluminum Sodium Flouride	...	....	....	...	...	10.	...

*Recommended by the French Laboratories of the Autogenous Welding Association.

Where a flux is used in welding aluminum, the edges and adjacent surfaces should be well scraped and cleaned as the flux is only intended to eliminate the oxide and not grease and dirt. In welding heavy sheets the edges should be beveled and in light ones the welding will be aided by flanging the edges about $\frac{1}{16}$ in.

Aluminum castings are handled a little differently from sheets or plates. As previously mentioned castings are of different composition. Since the metal has a low melting point, high conductivity, and becomes rather fragile previous to fusion, preheating and cooling must be carried out very carefully. The average aluminum casting is somewhat complicated in its design, hence the necessity of skillfulness in carrying it through the preliminary heating period.

The use of a flux on aluminum castings has been abandoned by the majority of welders. In place of it they break down and remove the oxide by means of a paddle, which is also used to smooth off the surface of the weld after it is completed. In many cases it is an advantage when working on castings, not to bevel the edges.

In most cases aluminum articles should be preheated to some extent before welding. In certain cases the playing of the secondary flame on the object will be sufficient; in others a more thorough treatment is required, such as charcoal or coke. On the regular run of castings it is safest to preheat to about 500 or 600 deg. F., which on iron would correspond to a low red heat. In the case of a broken lug or piece of a flange, it is often really dangerous to preheat as it may cause the whole piece to collapse or distort. The beginner should also be very careful about shifting or turning a hot aluminum casting as it may get out of shape or crumble into pieces. Since the metal is so apt to crumble when hot it is advisable

for the beginner, and often the expert, to back up the parts. This may be done by molding a backing out of asbestos fiber 2 parts and plaster of paris 1 part, made into a thick paste with water. Have this mold about an inch thick and perfectly dry before setting in place. Fireclay may also be used in many cases to back up or support fragile parts. When the weld is completed the casting should be allowed to cool very slowly and evenly. A preheating furnace suitable for both preheating and slow cooling is shown in Figs. 199 and 200. This heater is made by the Geist Manufacturing Co., Atlantic City, N. J., and is known as the Wiederwax preheater. It has eight gas burners entering from each end and extending to the middle. This makes it possible to heat any section or all of the top, as desired. The top has parallel grate bars to support the work and the gas burners are buried in pieces of refractory, heat-retaining material, so that parts are heated with the use of a minimum

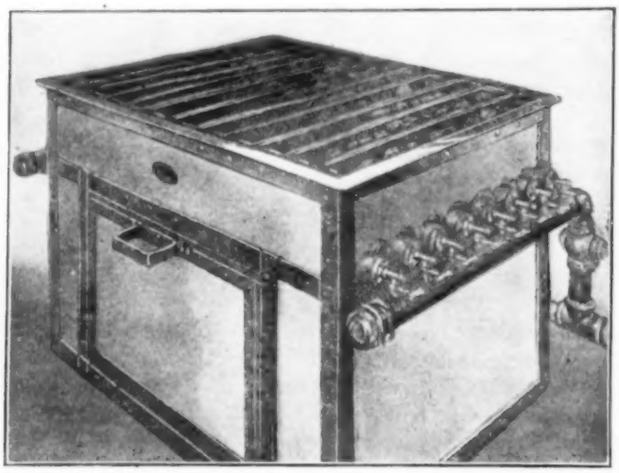


FIG. 199. THE WIEDERWAX PREHEATER

amount of gas. After the welding is done, the work is placed in the oven underneath the heaters and slowly cooled.

When using this heater or welding at any time, the work should be covered with asbestos sheet as much as possible. The iron puddling rod should not be allowed to get too hot or oxide of iron will be formed and scale off, making a defective weld.

Only a small amount of metal from the welding rod should be added at a time and this must be thoroughly stirred or "puddled" until a pool is formed that insures perfect fusion with the surrounding parts. Use the puddling rod to scrape off surplus metal while it is in a pasty condition. The beginner will find it a little difficult to manipulate the puddling and the welding rods alternately with the same hand but this becomes a habit with practice, and many do this by holding them between the fingers so that neither needs to be laid down. The property of conducting heat is greater in aluminum than in iron, but as the melting point is much lower, about the same size torch tip is used as for cast iron of corresponding thickness.

Filling a Large Hole

The *Journal of Acetylene Welding* says that when the filling of a large hole is required a chill of galvanized iron is provided, backing up the hole and welding against this when filling the hole with aluminum. Galvanized iron is preferable to any other material, such as tin or iron, since it peels away from the aluminum quite readily, and can therefore be easily removed after the weld has been completed. This is undoubtedly due to the zinc content of the galvanizing composition.

The chief value of the use of the chill is that it causes the filler to cool and harden quickly, thereby preventing it from contracting after the weld is finished. It also prevents the heat of the weld from spreading, which might cause the job to crack back.

The chill causes the added metal to cool almost as fast as it is connected to the edge of the break. After the weld has been finished and cooled, the chill can be removed by gently prying it away from the weld by means of a cold chisel.

Brass and Bronze

The composition of brasses and bronzes varies so widely that it is not good for a welder to use welding rods of the same composition for the general run of repair work. However, rods of Tobin bronze or manganese bronze are very satisfactory for all-round work. Where it is important to match the color of the weld with that of the surrounding metal it is necessary to use special rods of practically the same composition as the welded metal, and also to use extra care with the torch. This latter will be better understood when the welder knows that several of the alloys such as zinc, tin, etc., used with copper to make brass or bronze, volatilize easily and in so doing change the character of the metal. These metals should be prepared in the same way as any other. They must be so placed as to not move during the welding. Fireclay may be used to back up pieces in danger of collapse. The end of the flame cone should not touch the metal,

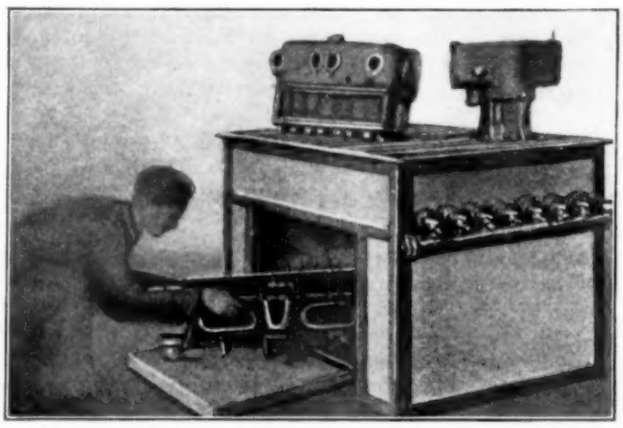


FIG. 200. SHOWING THE SLOW COOLING OVEN

but should be kept some distance above it. If a white smoke rises, or, as in the case of bronze, the metal bubbles, remove the flame, as it indicates that too much heat is being used and some of the elements are passing off in vapor. Do not breathe this vapor as it is poisonous. It is desirable to use a tip about the same size as for cast iron. A flux should be used though not too liberally. Calcined borax is good. Boracic acid is also good and, if used, may be applied by dipping the hot rod into the powder from time to time. The principal points to watch are not to heat too hot; do not move the parts until well cooled; do not use too much flux, and be sure to guard against caving in or distortion of the work by properly supporting it

previous to heating. If the metal is porous on cooling it is a sure sign that too high a heat was used.

Cast Iron

When cast iron is molten it oxidizes very rapidly. The oxide which begins to form at a bright red heat, melts at a temperature of 2400 to 2450 deg. F. Since the metal itself melts at a temperature several hundred degrees below this, it can be seen that the oxide will not be melted at the same time as the metal. In order to break the oxide down and allow the metal to flow together a flux must be used. A properly formulated flux will dissolve the oxide and float it to the surface, so that it may be removed by scraping the molten surface with the end of the welding rod. The welder should tap the end against something to free it from oxide before continuing to add it to the weld.

A good flux for use in welding cast iron may be made up of equal parts of carbonate of soda (washing soda) and bicarbonate of soda (baking soda). There is practically no advantage in using the pure chemicals in this case as the commercial product, which may be obtained at the grocery store, will do as well as any. The two sodas should be thoroughly mixed, however, which may be done by running them through an old coffee mill several times, or thoroughly shaking and sifting in a sieve. The flux is applied, as in most other cases, by dipping the hot welding rod into it.

Cast iron is quite fluid when melted. For this reason it offers considerable difficulty where vertical or overhead welding is attempted. Also its fluidity causes it to entrap gases, dirt, and oxide. These may be removed by proper manipulation of the torch and welding rod. As the molten iron can be forced ahead of the weld very easily, adhesion to the cold metal will result, if the welding is not watched carefully.

The silicon will volatilize to some extent in the molten metal and the lowering of the amount of this constituent will seriously increase the hardness of the metal. In order to compensate for this loss, a welding rod is used that contains from 2.75 per cent. to 3.5 per cent. silicon. The other substances such as sulphur, manganese, and phosphorus should be kept within rigid limits. The welding rod should be soundly cast, free from dirt, sand, scale, rust, etc.

The welding flame should always be neutral. The flame should be applied to the weld at such an angle that the metal will not be blown ahead. Inasmuch as the metal is quite fluid when molten, the welding is carried on in a series of overlapping "pools" or puddles. The welding rod is applied by placing it in these pools and playing the flame around it. The welding is aided by continually "working" the rod in the weld in order that blowholes, dirt, scale, etc., will be forced out.

The central jet of the flame should never impinge on the molten metal. It should be held $\frac{1}{8}$ in. to $\frac{3}{16}$ in. from it. Occasionally it is necessary to remove a blowhole, in which case the hole is burnt out with the flame and then the metal is worked over with the welding rod. The working over of a weld should be avoided unless it is absolutely necessary. If it is necessary to do this the welding rod should be used always, for otherwise a portion of the silicon will be lost.

When the weld is finished and it is still hot, the accumulation of scale, dirt, flux, etc., on the surface should be removed by scraping with a coarse file or other tool. This is a superficial coating that, when cold, is very hard.

As soft welds are nearly always desired, the casting should be cooled slowly and evenly. Where the work is complicated or of heavy section, it is by all means best to reheat it to a good red heat and then allow it to cool slowly. In some cases where charcoal has been used it is sufficient to allow the casting to cool in the preheating fire, without the additional reheating.

Cast Iron to Steel

To weld cast iron to steel, cast-iron rods must be used as the welding material. The steel must be heated to the melting point first, as cast iron melts at a lower temperature. A very little flux should be used.

Copper

Copper usually is produced in an almost pure homogeneous form. The impurities are present in small amounts and are not affected materially by fusion. Copper is a good conductor of heat, and is very tough, ductile, and malleable.

From these properties it would appear that it is easily welded. Unfortunately this is not true. There are few welders skilled in the handling of this metal.

Copper has two very pronounced properties under the welding flame. It absorbs gases very readily, notably carbon monoxide and hydrogen. These are released when the metal begins to solidify, with the result that they remain entrapped, producing a porous structure.

Copper oxidizes very rapidly when undergoing fusion. The molten metal has the property of dissolving the oxide thus formed. It will take up such large quantities of it that the mechanical properties of the weld will be affected. In addition to these two peculiarities the tensile strength of copper decreases rapidly as the temperature is raised, particularly from 500 deg. F. upward. The effect of temperature is so severe that at 900 deg. F. the tensile strength is only 40 per cent. of that at atmospheric temperatures.

Because of this weakening under heat, the strains resulting from contraction in the weld during cooling must be carefully dissipated, otherwise the metal in the weld or adjacent to it will fail.

A neutral flame should always be applied in welding this metal. If an excess of acetylene is used the products of combustion are richer in those gases which are easily absorbed. If an oxidizing flame is used, the weld becomes saturated with the oxide.

A larger sized torch tip than the melting point of copper indicates is used because of the high thermal conductivity. Where possible, auxiliary heating, such as air-gas flames and charcoal fires, should be employed. This is done not only from the standpoint of economy, but it also aids greatly in the success of the weld.

The torch flame should play on the weld in a vertical direction. The metal when molten is quite fluid, and for this reason if the torch were applied at an angle the metal would be blown ahead, producing adhesion. Also, by applying the torch vertically the molten metal is protected from the oxygen of the atmosphere by means of the enveloping flame.

Copper, if properly prepared and free from grease or dirt, does not need a flux.

The factor that contributes most to the successful welding of copper is the use of a properly formulated welding rod. Such a rod will overcome, to a great extent, both the absorption of gases and the solution of the oxide. It is not considered practical to remove the oxide in the weld by means of a flux, because it is dissolved in the metal. A welding rod is needed that has combined with it a reducing or deoxidizing agent. The reducing agent has a greater affinity for oxygen than copper, hence it combines with it and brings it to the surface in a fluid form. This material acts as a glaze or protecting coating for the molten metal beneath it, with the result that it tends to retard the absorpion of the gases.

Several materials, when added to a pure copper rod, have proved to be beneficial. The most prominent element at this time is phosphorus. It should be present in amounts not over 1.0 per cent.; otherwise the metal will be pasty and the weld will be weakened.

Newly welded copper has only the strength of cast copper, but after welding, the grain of the weld and the metal adjacent can be improved by hammering at a low heat.

Copper to Steel

If it is desired to weld copper to steel, heat the steel to a welding heat, then place the copper in contact. The metals will then fuse together. Take away the flame as soon as the copper flows properly. No flux is needed.

Lead

Lead can be readily welded. The process, however, is usually known as "lead burning." The gas torch provides a means of doing this work quickly and at a low cost. Skill in the manipulation of the torch is necessary, particularly on vertical seams. A light torch should be used. When welding sheets or plates, proceed as in lead burning by other processes.

The burned joint on a lead or block tin pipe line is not only a neat and permanent joint, but is all lead, and a block tin line is all block tin. The joints are fused together with the addition of enough metal of the same kind. If, for instance, a lead pipe line is to carry acid, the burned joints contain no solder which could be attacked by the acid.

In preparing lead pipe for welding the two pipe ends are scraped clean for about an inch back, and are tapered slightly at the edges. It is not necessary to drive one pipe into the other. The two ends are merely placed in contact and welded or "burned" with the addition of more lead to fill up the joint. No flux, no grease and no "wiping" of any kind is needed.

Malleable Iron

The manufacture of malleable iron has made enormous progress during the last few years, and while formerly malleable iron was really an unknown quantity and might contain different mixtures, from white iron to hard steel, in the same casting, a great uniformity is now obtainable by adherence to strictly scientific methods.

The Associated Manufacturers of Malleable Iron has set a standard of quality, to which all its members must adhere rigidly and castings procured from one of its members may be relied on to consist of a uniform and thoroughly high-class product.

While formerly the welding of malleable iron was considered almost impractical on account of the different structures in one and the same casting, it may now be welded with almost a certainty of success, if the casting was made in accordance with the rules of the association.

The break on malleable iron is prepared exactly the same as for any welding job, cleanliness in this instance being especially desirable, since dirt tends to weaken the weld considerably. Allowance should be made for the effects of expansion and contraction; malleable iron is less liable to break than cast iron, since it is ductile, but will be distorted unless such provisions are made. Use for flux the same powder used for brass—that is: borax or a purchased mixture.

As with cast iron, do not let the end of the cone touch the casting, but hold it just a little distance away. Watch the metal carefully and as soon as the metal begins to melt, add the filling rod, either Norway iron or malleable rod of the same grade as the casting.

However, not all malleable castings are of the high degree just described. They were originally white cast iron, very brittle and hard. By heat-treatment, the carbon content is changed, and instead of the brittle casting, it becomes ductile, fairly soft and changes to a darker color. Just how far into the body of the metal this change penetrates depends upon the size of the casting and the length of the heat-treatment, so that a malleable casting, as it is generally called, may be steel on the surface, a semi-steel part way through and white cast iron at the core.

Very small castings sometimes are steel all the way through and we may weld them without flux, using Norway iron or mild steel as the welding rod.

In nearly all cases, however, it will be found that the casting, if not made to association specifications, is composed of different metals—if the break is examined, we can tell this by the different colors. It is obvious that such a casting cannot be welded, since it would be extremely difficult to determine just where one metal left off and another began. The practice of using cast iron as a welding rod on malleable castings is not a good one, since the bond is very brittle and in all cases where strength is desired we would better use manganese or Tobin bronze—in this way securing a brazed joint instead of a welded one, of a different color than the casting but with the factor of strength a big one.

Watch the metal carefully and when the spot the flame is playing upon reaches a bright red heat, bring the bronze welding rod, which has previously picked up some borax, down upon this section, being careful that the cone does not come directly in contact with the bronze rod. Bronze melts at a lower temperature than malleable iron and with the iron at a bright red heat, and with plenty of flux used, it will be found that the bronze attaches itself to the iron. We must not, however *melt* any portion of the malleable iron and we must not play the cone directly on the iron or on the bronze.

Monel Met

Technically, monel metal is an alloy of nickel and copper, containing about 67 per cent. nickel, 28 per cent. copper, and 5 per cent. of other elements. This remaining 5 per cent. consists partly of iron from the original ore and partly of manganese, silicon, and carbon introduced in the process of refining. It contains no zinc or aluminum. The alloy can be machined, forged, soldered and welded, both electrically and by the gas torch. In the automobile industry it is used for float valves in

carburetors because it combines hardness with non-corrodibility. Borax or boracic acid may be used as a flux.

Nickel

Nickel melts at 2600 deg. F. and when melted has the property of absorbing large amounts of various gases, especially oxygen. The gases so absorbed remain when the metal cools, making it very porous. Nickel also has a great affinity for sulphur. It is often stated that nickel cannot be welded, but this is an error, although it is an extremely difficult metal to weld satisfactorily. Anodes used in nickel plating, may be fused together without flux as the blowholes do not affect the conductivity to any appreciable extent. However, where a weld is wanted free from blowholes, the nickel pieces should be laid on a heavy plate heated bright red or white, and the nickel heated to a bright white with the gas torch. The joint should then be carefully hammered with a light hammer. Previous to heating the nickel should be freed from grease or oil and scraped well back from the weld.

Steel

Steel welding on a commercial scale should never be attempted until after the operator has proved to his own satisfaction that the weld is strong by welding together mild steel plates of $\frac{1}{8}$ to $\frac{1}{4}$ in., sawing them through the weld to make sure that the material is really bonded and testing them by bending back and forth in a vise.

Steel melts at 2500 to 2700 deg. F. When molten it is not extremely fluid. At dull red heat it begins to oxidize rapidly. The oxide, which melts at a temperature of several hundred degrees below that of the metal, remains at the surface and can be easily removed. A flux is not necessary, although some welders use a little borax. Close attention must be paid to the removal of the oxide, however, for its presence is very harmful. It is a common fault to have layers of oxide in the weld, which cause a laminated structure that weakens it.

Steel does not melt rapidly. It gradually comes to fusion, confined to small areas. Because of this, the weld is made up of small overlapping layers. The strength of the weld depends greatly on the thorough bonding of these layers to each other and to the beveled edges of the piece being welded. It is a common fault to force the metal ahead of the welding area and allow it to adhere to the cold sides of the beveled edges.

A welding rod of over 99-per cent. pure iron wire is commonly used. Occasionally a nickel-steel rod is used with good results on such work as crankshafts. A mild-steel rod is particularly satisfactory on steel castings.

Thickness of Steel	Diameter of Welding Rod
$\frac{1}{8}$ in.	$\frac{1}{16}$ in.
$\frac{1}{4}$ in. to $\frac{5}{16}$ in.	$\frac{1}{8}$ in.
$\frac{1}{4}$ in. to $\frac{3}{8}$ in.	$\frac{5}{16}$ in.
$\frac{1}{2}$ in. and up	$\frac{1}{4}$ in.

Steel is very sensitive to the welding flame. An excess of acetylene tends to carbonize the metal; an excess of oxygen tends to oxidize. Therefore, a neutral flame should always be used and should be tested frequently in order that it be kept in proper adjustment.

Failures due to expansion and contraction are not numerous, because of the toughness and strength of the metal. If expansion and contraction are not properly taken care of, however, warping and buckling will surely take place, and internal strains will exist in the weld.

These can be avoided by properly setting up the work and with proper preheating methods.

The strength of a steel weld can be improved by mechanical treatment. Hammering is the most common method employed. After the welding has been completed, the entire weld should be heated to a bright red heat, and the hammering carried on at this temperature. If the hammering is done at a lower temperature, the weld will be weakened instead of strengthened.

The welder should always keep in mind that the higher the percentage of carbon in the steel the greater is the danger of burning the metal, with its consequent weakening effect.

Steel castings should be handled in a manner similar to cast iron. They may be preheated and prepared in the same way. Cast steel as a rule has a percentage of carbon between that in mild steel and grey cast iron. As a filler, good results will be obtained if cast bars of the same material are used. If not available, use vanadium steel or Norway iron filler.

While little work is done in welding high carbon or hard steel, the following instructions are given as a guide to the operator in case of necessity. Parts should be prepared for welding as for wrought iron or steel. Use a larger tip than for the same thickness of mild steel. For filling material where the parts are to be hardened, use ordinary drill rod. Drill rod is a hard steel which is used by tool manufacturers in the manufacture of drills, reamers, etc. Ordinary mild steel cannot be tempered and this is often necessary when high carbon or hard steel parts have to be welded. Employ cast-iron flux. Execute the weld very rapidly as there is a tendency for the metal to burn easily and also to decarbonize; that is, to burn out the carbon, leaving the metal in poor condition. A very slight excess of acetylene in the welding flame may be advantageous.

To weld high-speed steel to ordinary machine steel, the end of the high-speed steel to be welded must first be heavily coated with soft special iron. It can then be welded to ordinary machine steel without burning, but it takes an experienced welder to make a good weld of this kind.

Special Steels

There are many special or alloy steels used in the metal industry. The operator is often called upon to attempt welding on these. Many automobile and locomotive parts are made from special high-carbon steels, and often these castings or forgings undergo, during manufacture, special heat-treatments which are in many cases more or less of a secret process. It will be appreciated that welding with a high-temperature flame must necessarily counteract the effects that were produced by the heat-treatments, consequently, to make the part efficient it is essential that after welding, the piece be properly heat-treated by an operator skilled in such work. The services of such a man are rarely available, therefore, the results obtained when welding high-carbon alloy steels will be uncertain. Fortunately, however, many of the alloy steels used in practice are not high carbon and can be welded satisfactorily.

Manganese Steel (low carbon) is welded quite readily. The manganese acts as a deoxidizing agent; that is, it counteracts the effect of burning the metal. If possible, use a filling material of the same composition as the part welded. If this cannot be obtained use Norway iron.

Nickel Steel (low carbon) can be welded without difficulty in exactly the same way as mild steel, but nickel-steel filling rod must be used.

VANADIUM STEEL (low carbon)—This is probably the most commonly used steel alloy. Very fortunately it is extremely easy to weld, and flows much more readily than ordinary mild steel. Weld as mild steel, but use vanadium-steel filler.

CHROME STEEL is in the class of mild or low-carbon steel and can be welded readily. Weld as mild steel. Use a chrome-steel filler. Many chrome steels, however, are in the high-carbon or hard-steel class.

WROUGHT IRON may be easily welded without a flux though a little borax or other flux is sometimes advisable. The same general rules apply as for mild steel.

GALVANIZED IRON cannot be welded, since the iron is covered with, and to a greater or less extent impregnated with, a lower melting metal.

GERMAN SILVER, in many cases, is considered unweldable, due to its absorption of gases. For practically all commercial purposes, it may be bonded, using the same flux as for brass and a strip of German silver for the welding rod. Especial care must be given to expansion and contraction.

WHITE METAL CASTINGS used for die molded purposes usually are composed of aluminum, tin and zinc in varying proportions, but nearly always with the lower melting metals in the larger proportion. While the castings have a good deal the same appearance as aluminum, they are considerably heavier. They may be considered unweldable.

SILVER acts very similar to nickel and should be welded in the same way by heating and hammering. However, soldering usually answers all purposes.

GOLD welds very easily and the pure melting process is all that is needed.

Germany's Industry Recovering

SPECIAL CORRESPONDENCE

In a recent speech, the German secretary of state for trade and industry exhibited the fact that German export has *ad valorem* almost reached the pre-war average. The revival of export commenced last spring and has since then increased at a remarkable rate. This fact is not so much due to the initiative of the Germans themselves, who for the most part have shown no great indication of returning enterprise, as to the foreign buyers. The latter, attracted by the low rate of exchange, have appeared in ever-increasing numbers.

Export sales have been contracted to such an extent that the government, although keenly interested in the increase of export, has assumed strict control of all export with a view to bringing up the prices to the utmost limit permissible with regard to foreign competition. An agio (premium on the exchange of one currency for another) has been placed upon certain kinds of products, reaching as high as 70 per cent. of the home price in the case of machine tools. This procedure is of course not intended to prevent dumping in the interest of foreign competitive industries but simply to exhaust all the possibilities of the situation.

Still it can be said that every article turned out finds willing buyers from almost every country, and if the total of German export is not larger than it is now, it is not the fault of the buyers, nor of the manufacturers. The latter are doing their utmost to increase production, seeing that sales conditions are as favorable as they ever hoped they could be again. They are however sorely hampered by the labor conditions, especially the abolition of the piece rate, the inefficient supply of coal and other raw material.

The coal situation is however slowly improving and in the labor question the manufacturers are regaining confidence. The strike of the metal workers in Berlin is to all appearances the last effort of the radical labor movement. It is meant by both parties to be a criterion of the opposing forces and will no doubt be fought out to the bitter end. It is however the common belief that the employers have the upper hand, that the strike will lead to a settlement of the labor question and open the road to an enlarged activity of German industry.

All efforts are directed to increase the production. A reduction of wages will for a long time be out of the question. Even the predicted defeat of the workmen in the Berlin strike will not make a reduction of wages possible. The cost of production is high and still increasing. The whole German export and in fact the welfare of the industry rests at present on the foundation of the depreciation of German money. If the latter, by credit operations or other financial operations, was allowed to reach a more normal value, German industry would face a catastrophy. The figures in the accompanying table, taken from the machine-tool industry, will demonstrate this fact. These figures denote home market prices. For export an agio is added up to 70 per cent. of the home price, according to the dictates of foreign competition.

	Present German Price	Normal Dollar Equiv. 4.20 M. = $1	Present Dollar Equiv. 25M. = $1
Screw-cutting lathe:			
Medium quality, flat bed, 10 in. swing, 2-ft. bed	3,200 M.	$762	$128
12-in. swing, 3½-ft. bed	5,450 M.	1,295	218
Screw-cutting lathe:			
Good quality, flat bed, 16-in. swing, 3½-ft. bed	10,000 M.	2,380	400
20-in. swing	11,000 M.	2,619	440
Engine lathe:			
With lead screw and feed shaft, V-ways, cheap make, 18-in. x 3½-ft.	8,000 M.	1,904	320
Slotting machine:			
8-in. stroke	7,000 M.	1,667	$280
Shaping machine:			
16-in. stroke	6,000 M.	1,428	240
24-in. stroke	10,000 M.	2,381	400
Automatic screw-cutting lathe:			
¾-in. stock	12,000 M.	2,857	480
Milling machines:			
Plain No. 1 size 8 x 32-in. table	5,000 M.	1,190	200
Universal 12 x 48-in. table	12,000 M.	2,857	480
Turret lathe:			
12-in. spindle bore	7,000 M.	1,667	280
Planing machines, 36 in. x 8 ft	19,500 M.	4,643	780
Bolt-cutting lathe:			
10 in. x 3½ ft	9,000 M.	2,142	360
Gear-cutting machine:			
Up to 20-in. diameter	25,000 M.	5,952	1,000
Up to 32-in. diameter	35,000 M.	8,303	1,400
Gear generating machine (Fellow's System):			
Up to 32-in. diameter	36,000 M.	8,571	1,440
Plain cylindrical grinding machine:			
16 in. x 3½ ft	12,000 M.	2,857	480

These figures show in comparison to pre-war prices an advance of between 600 to 800 per cent. In no other country have prices risen at the same rate. The export situation of German industry is therefore absolutely dependent on the rate of exchange. Germany's industry is making great strides toward recovery and if the present money situation is allowed to continue she will have an almost unique position on the foreign market. Existing conditions are not expected to last forever, and most people would rather see a better state of the exchange than an unduly inflated export, but there is no doubt that as long as the present conditions last the German industry will strive to utilize them to the fullest extent.

Machining Operations on Die Stocks

By J. V. HUNTER
Western Editor *American Machinist*

This article illustrates and describes the making of large die stocks of the kind that are used for the hand threading of pipe. The jigs used are designed to permit the greatest possible number of operations at one setting.

SOME of the methods used by the Reed Manufacturing Co., Erie, Penn., in manufacturing die stocks for pipe dies, are here shown.

The stocks are made from malleable-iron castings, one of which may be seen in Fig. 1. After the castings are cleaned the first operation is the blacking or japanning, which is done at this stage, so that after the machining operations are finished the machined surfaces, particularly the bearing spots for the dies, may remain clean and free from enamel.

When the japanning is done first it is a simple operation of dipping, while if made to follow machine operations it is necessary either to apply the enamel with a brush or to make an extra operation of scraping the machined surfaces, which operation usually costs more than the machining.

The surfaces *A* are milled with the casting in a horizontal position on the indexing fixture *B*. The narrow cutters *C* finish the die surface completely, passing the lugs *D* without interference, and at the same time the cutters *E* finish the top of lugs *F*. The fixture is capable of being revolved around a central pivot and locates the two cuts exactly 90 deg. apart.

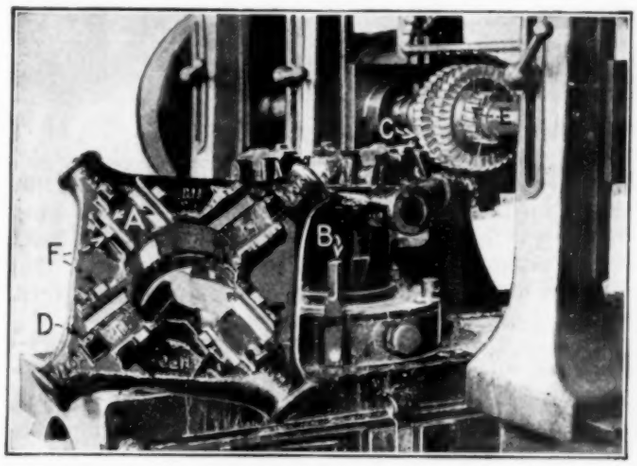


FIG. 1. MILLING THE CHANNEL ON LARGE STOCKS

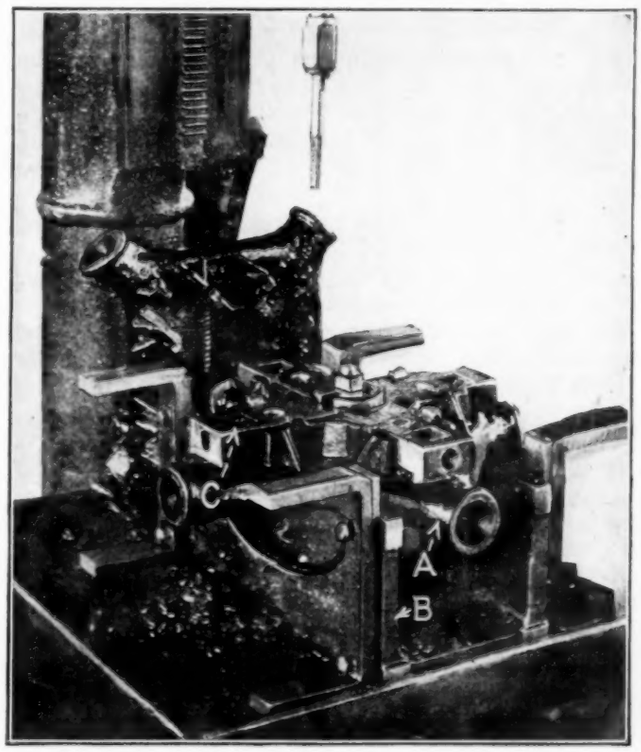


FIG. 2. DRILLING ALL SIDES OF STOCK AT ONE JIG SETTING

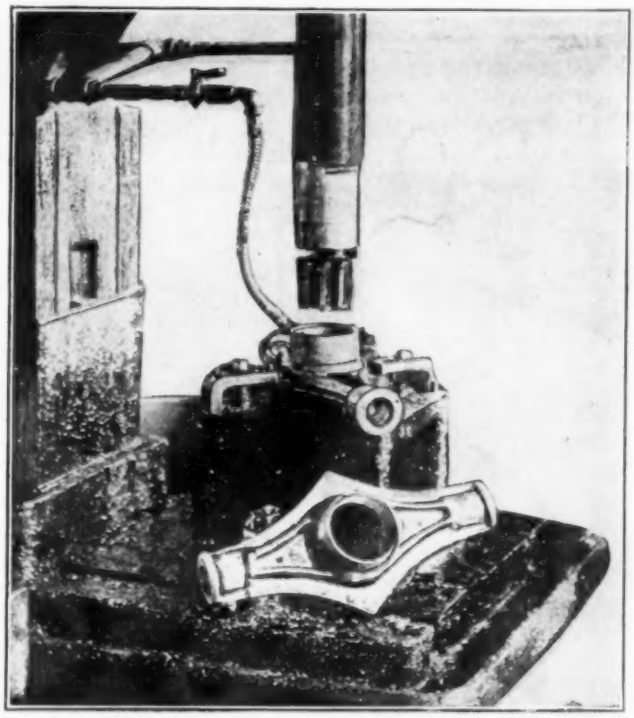


FIG. 3. TAPPING SMALL STOCK FOR SCREWED-IN GUIDE BUSHING

The next operation is drilling the sides, which is done in a jig at a single setting. The part *A*, Fig. 2, is clamped in the jig *B*, which has legs on all sides, so that it may stand in six different positions, and drilling operations are performed on five sides. A brace *C* fits into one of the slots which have just been milled to align the work. While in the position shown all holes are drilled and tapped on the face side. The four handle holes are drilled by standing the jig on the four respective sides and are later tapped in a similar manner.

Fig. 3 shows the tapping of one of the smaller sizes of stocks, for the screwed-in die bushing, the work being done on a Colburn vertical drilling machine. A gang drilling machine, Fig. 4, is used for finishing the

outside and reaming the inside of the pipe bushings, or "guides," as they are called by the trade. The hollow head with adjustable cutters for finishing the outside of the guide at the same time that the reamer is finishing the inside, is plainly shown in this illustration. To avoid having a lot of duplicate tools the machine is arranged so that the four spindles are used, each on a different size of guide bushing. The bushings have a groove cut midway of their length, as shown at *A*, Fig. 5, to give a hold for the thumb screw. This groove is cut by the device *B* mounted on the spindle of a vertical drilling machine. The body slips down over the

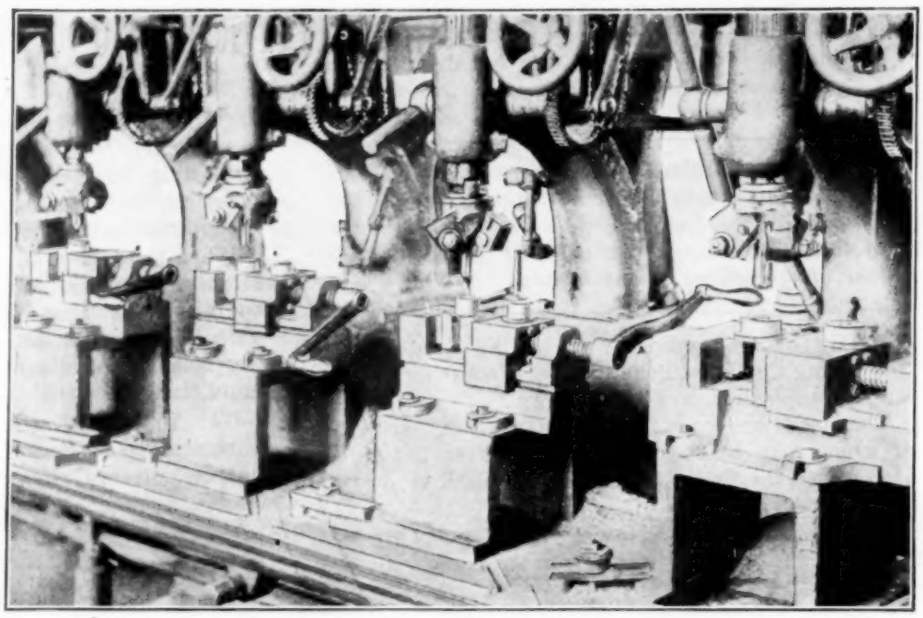


FIG. 4. FINISHING INSIDE AND OUTSIDE OF GUIDE BUSHINGS

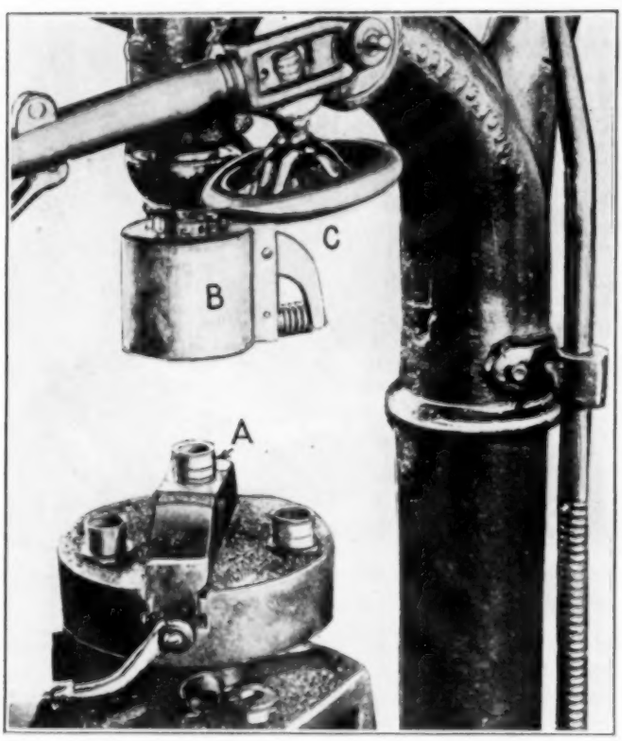


FIG. 5. DEVICE FOR TURNING GROOVE IN BUSHINGS

bushing and the pressure forces out a small cutting tool which makes the groove. When the spindle is stopped the spring-operated lever *C* withdraws the tool from the work and permits the spindle to be raised.

What's in a Name?

BY L. D. HAYES
Professor of Machine Design, West Virginia University

One paragraph of the comment under the above heading, as made by Sandy Copeland and printed on page 816, Vol. 51 of *American Machinist*, is deserving, perhaps, of further attention. There is a great need for a clearer understanding concerning the misuse of the term "spiral gear." It is to be presumed that when this term was first applied to gears it was with no more definite intent than as a descriptive adjective and that this was at a time when no other gear of similar form made a finer distinction necessary.

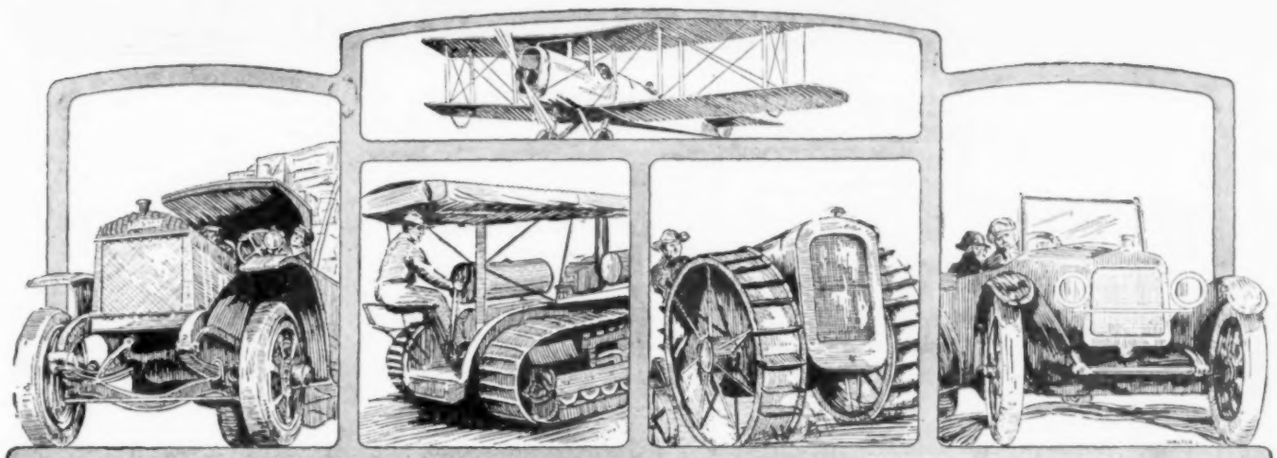
Unquestionably, the dictionaries sanction the use of the word "spiral" as a synonym for the noun "helix" or for the adjective "helical," even though not given as their preferred definition; but modern developments in gearing have made it almost imperative that there should be a more exact naming if endless confusion is to be avoided.

The confusion is greatly aggravated by the fact that a surprisingly large proportion of those using the term speak of a "spiral gear drive" as though no further explanation should be needed, no matter whether it is intended to apply to a pair of twisted, or herringbone, gears on parallel shafts or to a pair of helical gears on shafts which are neither intersecting nor parallel.

It cannot be emphasized too strongly that, even though a single twisted gear and a single helical gear may be identical in appearance and form, the methods of their operation and the theories of their design are wholly different. Only by the abandonment of the general and inaccurate term "spiral" and by the rigid use of the distinctive names "helical" and "twisted" can this confusion be eliminated.

It may be that Mr. Copeland is not quite accurate in saying of "the spiral gear—there 'haint no such animal' " as the writer has a distinct remembrance of a pair of gears, if they may be properly so called, in which the tooth of the driver extended in an Archimedean spiral slightly more than once around on the face of a rotating disk.

The cross-section of this spiral tooth was very similar to the common involute rack tooth profile. The mating gear was mounted on a shaft at right angles to that of the disk and the teeth were radial pins carrying rollers turned to an involute tooth profile. One revolution of the disk and spiral caused the gear to rotate one tooth. If this is not a spiral gear, what is it?



AUTOMOTIVE CONSTRUCTION

"Caterpillars" and Their Construction—III

By K. H. CONDIT
Associate Editor, *American Machinist*

The transmitting of upward of 120 hp. to a moving track going at a rate of three miles an hour over any sort of ground requires gearing and bearings not only rugged but accurate, and the controlling of such a mechanism presents problems with an individuality all their own. Steering automotive vehicles by means of the transmission is somewhat unusual. (Part II appeared in Jan. 1 issue.)

MANY an inexperienced automobile driver has involuntarily attempted to make his mount climb a tree, but the records show that in the vast majority of cases the tree had the better of the argument. It is a very different matter when a "Caterpillar" or a tank undertakes the same maneuver. The 120-hp. Holt "Caterpillar" can exert a drawbar pull of 15,000 lb. and naturally has a front-end push of about the same figure. Is it any wonder that stone walls and houses couldn't stop the tanks? As to trees, well, the sight of a Caterpillar mounting a good sturdy sapling is one to be remembered. If the sapling is very flexible the tractor ambles up to it, hesitates a moment as it hits the trunk and then begins to rise up on its hind legs, so to speak, until its weight bends the tree to the ground. Then it proceeds calmly along its recumbent adversary until it gets clear on the other side, when the tree, if it is limber enough, springs back to position somewhat the worse for wear. If it is not limber it is quite apt to lie flat at the first push and stay that way.

Although the maximum speed of the engine in the 120-hp. Holt is only 550 r.p.m., scarcely a quarter that of the average automobile motor, the maximum speed of the tractor itself is so much less than that of the car that a double reduction must be employed. The method of driving the chain track by a rear sprocket has been taken up in a previous article and it is now the intention to follow the transmission details up to the source of power.

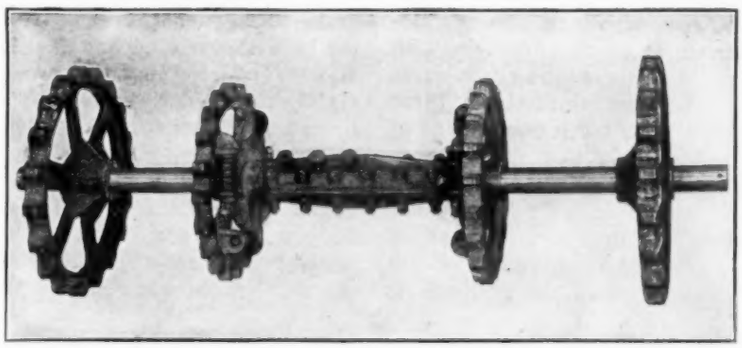


FIG. 17. MAIN DRIVE SHAFT

Power is delivered to the track-driving sprocket through the main drive shaft or sprocket shaft shown assembled in Fig. 17. In this cut, the outer sprockets drive the track and are keyed to separate shafts joined by the long coupling shown which is used instead of a differential gear arrangement. The line drawing of this assembly in Fig. 18 gives a clearer idea of the coupling device. The ends of the two shafts are reduced to form collars which fit inside a bronze split bushing *A*, called the tension coupling. This prevents end play and the outer part of the coupling, called the center truss, provides the necessary aligning support. The center truss is made in two halves which bolt together. In Fig. 18 the left-hand part of the center truss is set up tightly on the left-hand drive shaft while the right-hand part is bored out enough to accommodate a cast-iron bushing in which the right-hand drive shaft is free to turn. The bushing is located by dowels to insure alignment of the grease-cup holes in poth parts.

Motion of the main drive shaft is produced through the first-motion chain, right and left chain drive sprockets and right and left spring drivers. These parts, except the chain, are shown in Fig. 19. It will be seen that the sprockets are free to turn on the shafts and impart their motion to the spring drivers through heavy coiled

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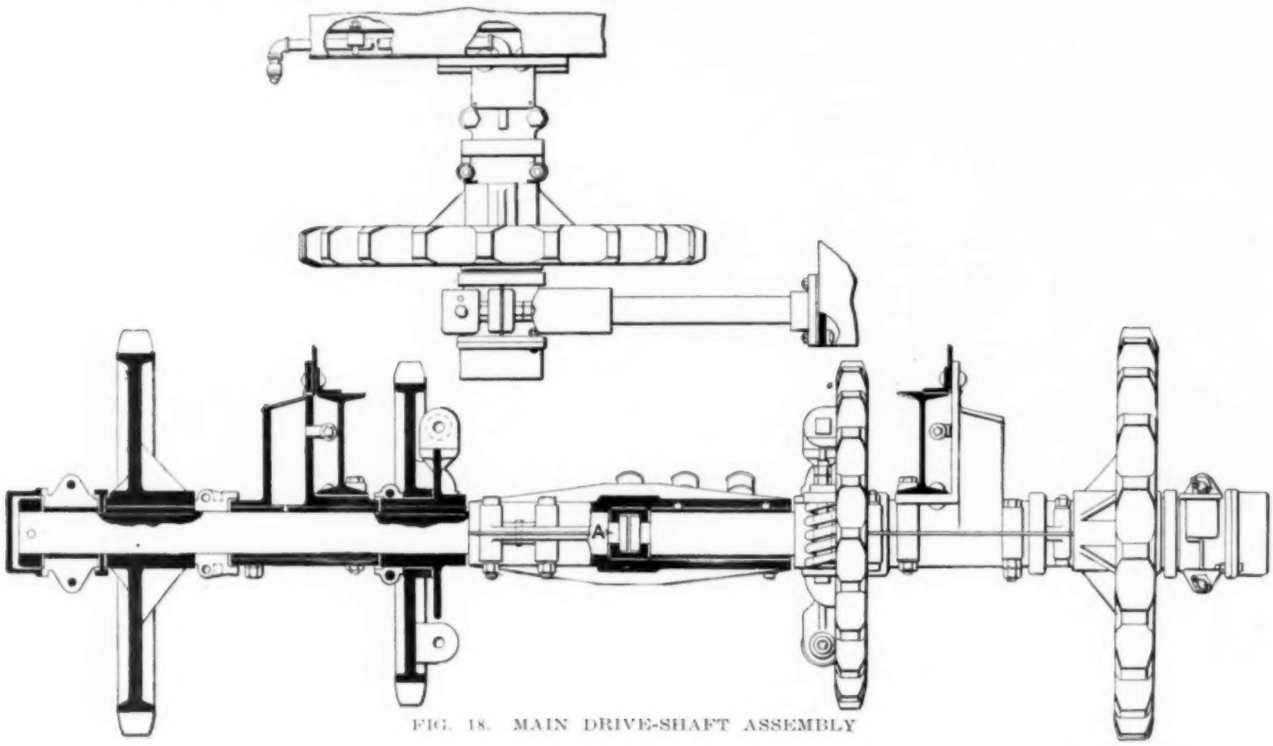

FIG. 18. MAIN DRIVE-SHAFT ASSEMBLY

springs for forward motion and through the bolts for reverse motion. Close adjustment of the bolt length is thus necessary. The spring drivers are a tight driving fit on taper keys. The shaft turns in four babbitt bearings of which more will be said in a later article.

The first-motion chains, one of which appears unlinked in Fig. 20, are driven by small sprockets with seven teeth. As there are 20 teeth on the chain drive sprockets the reduction at this point is practically three to one. The large wheel with bevel teeth on one side of it in Fig. 20 is the bevel gear and the plain wheel to the right of it is the friction wheel.

Inside of each of these wheels is a friction spider carrying two friction shoes which act as expanding clutches and permit either track to be driven independently. The result of releasing one of the frictions is of course to turn the tractor to that side. The need for a divided axle is obvious.

The details of the friction-shaft assembly are shown in Fig. 21, and Fig. 22 shows the friction spider and shoes removed. The shoes are faced with asbestos brake lining and prevented from shifting side-wise by the keys shown at *A* and *B*, Fig. 21. In Fig. 21 it will also be apparent that the two large friction wheels are rigidly attached to each other by the flanged coupling *C*, and that they turn with their shaft and the capstan pulley on the end of it, the small sprockets and friction spiders turning only when the friction shoes are engaged. These wheels are steel castings about 4 ft. in diameter and are bored and turned in a battery of Bullard Maxi-mills. The teeth on the bevel gears are cut in Gleason gear-shaping machines, two of which

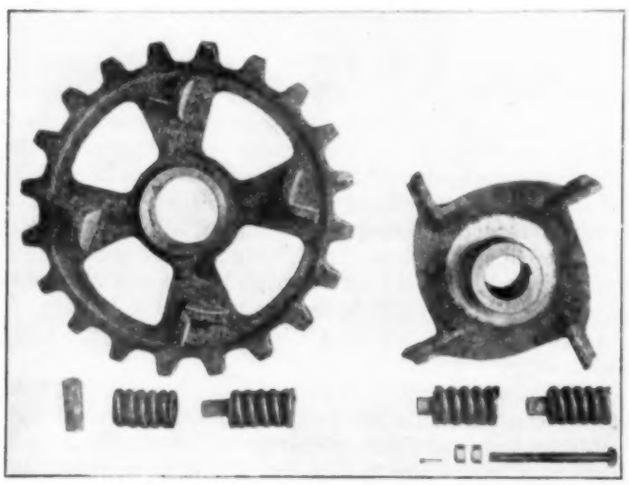

FIG. 19. SPROCKET AND SPRING DRIVER

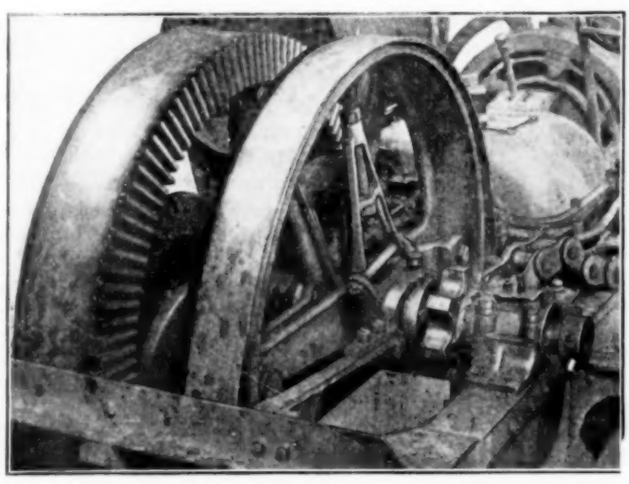

FIG. 20. FRICTIONS IN POSITION

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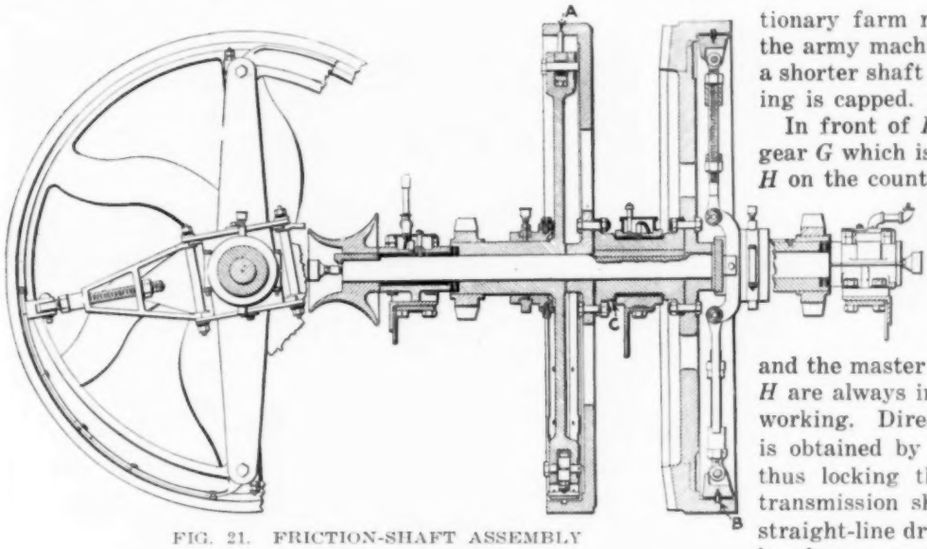


FIG. 21. FRICTION-SHAFT ASSEMBLY

are shown in Fig. 23. The average time for cutting the 106 teeth on one of these gears is 20 hours.

The 106-tooth bevel gear is driven by a 13-tooth pinion which is shown at *A*, Fig. 24. On the same shaft are two other gears, *B*, which is keyed on, and

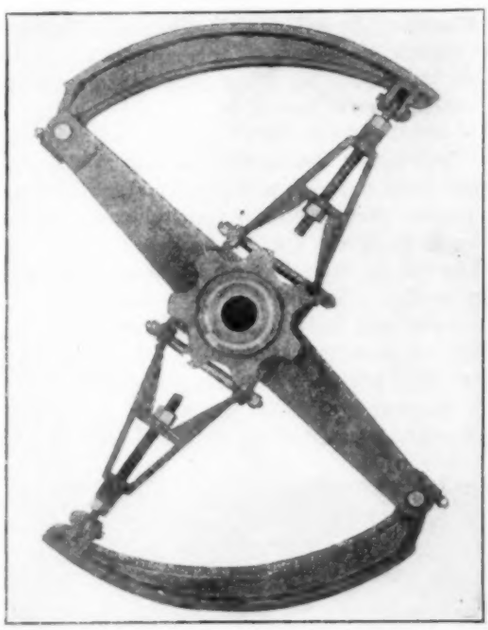


FIG. 22. FRICTION SPIDER AND SHOES

C which is bushed and free to rotate. The line assembly of the transmission given in Fig. 25 brings out these details somewhat better and shows the long tubular shaft integral with *B*. A jaw clutch *D* is mounted on two feather keys at the forward end of this shaft which ends at the face of the bevel gear *E*. Meshing with *C* and *E* is a bevel gear *F* keyed to the pulley shaft and performing two functions, that of acting as reverse idler and that of driving the power pulley on the outer end of its shaft. This pulley is used for driving all sorts of stationary farm machinery but is omitted from the army machines as shown in Fig. 25 where a shorter shaft is used and the end of the bearing is capped.

In front of *E* on the clutch shaft is a spur gear *G* which is keyed fast and drives the gear *H* on the countershaft. This gear is keyed on but the gear *J* on the other end of the countershaft is bushed and free. The jaw clutch *K* is carried on two feather keys.

With the engine running and the master clutch in, gears *C*, *E*, *F*, *G* and *H* are always in motion but not necessarily all working. Direct drive ahead at 2½ mi. per hr. is obtained by shifting *D* into mesh with *E*, thus locking the clutch shaft and the main transmission shaft together and furnishing a straight-line drive from the engine to the large bevel gear on the friction shaft. Reverse at the same speed is obtained by shifting *D* into mesh with *C*, thus locking *C* to the shaft on which it otherwise runs freely, and driving the main transmission shaft in the opposite direction from the clutch shaft through *C*, *E* and *F*. A high speed of 3 mi. per hr. can be obtained by leaving *D* out of mesh and meshing *K* with *J* in which case the drive will be through *G*, *H*, *J* and *B*.

The transmission gears are machined in Barber-Coleman gear-hobbing machines and hardened and heat-treated. The transmission cases are finished on an Ingersoll horizontal milling machine as shown in Figs. 26 and 27. They are held in special fixtures supplied by the Ingersoll Co. and enough fixtures are used to fill the table of the machine. Four of another type of

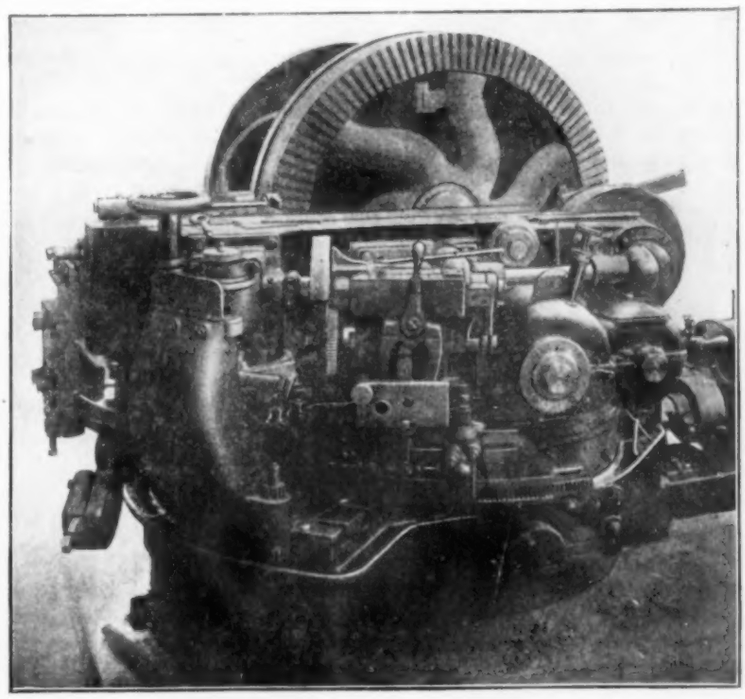


FIG. 23. MACHINING LARGE BEVEL GEAR

AUTOMOTIVE CONSTRUCTION

transmission cases can be set up at once. In this type the horizontal cutter spindles are also used instead of the vertical ones only, as illustrated. Special fixtures for this transmission case were also furnished by the Ingersoll people.

The motor is connected to the transmission by the master clutch shown in Fig. 28. The clutch is of the dry-disk type and is made up of two

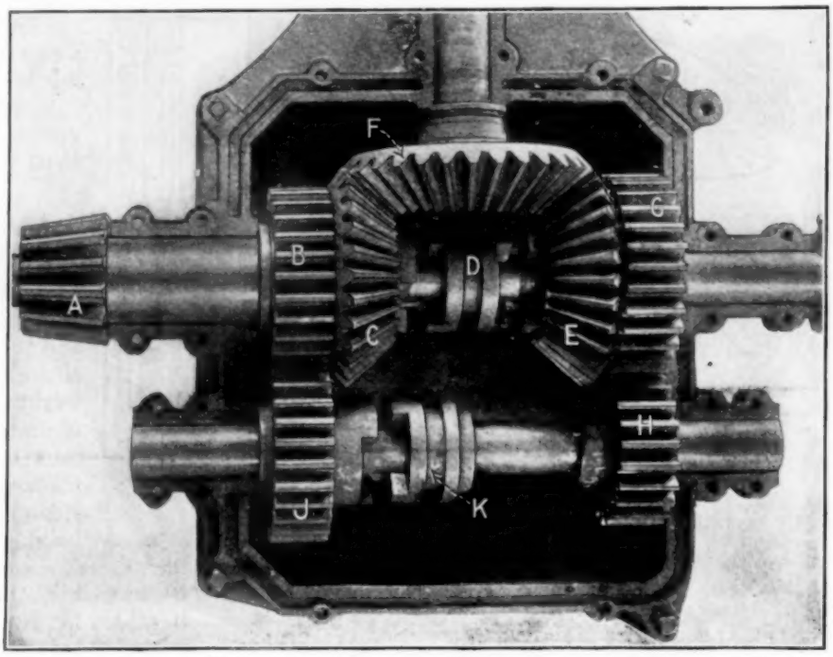


FIG. 24. TRANSMISSION IN NEUTRAL

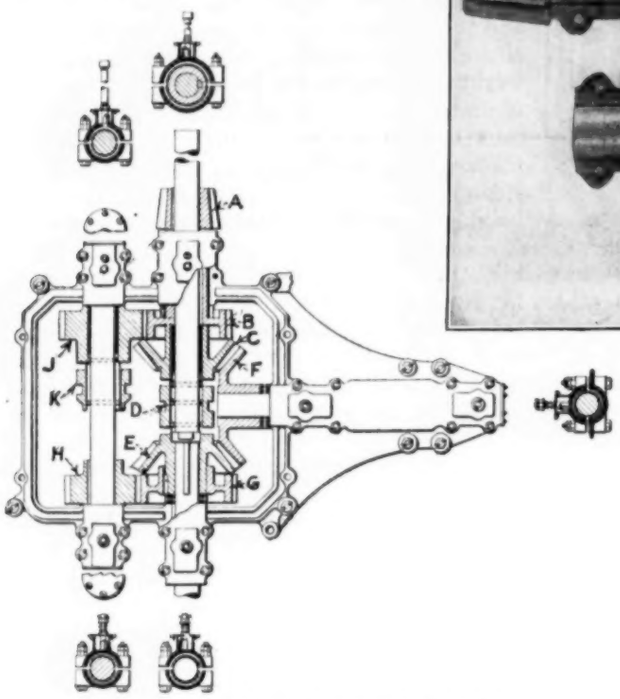
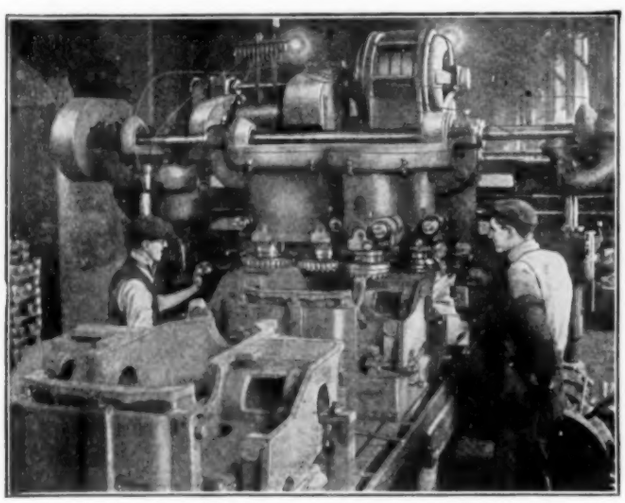


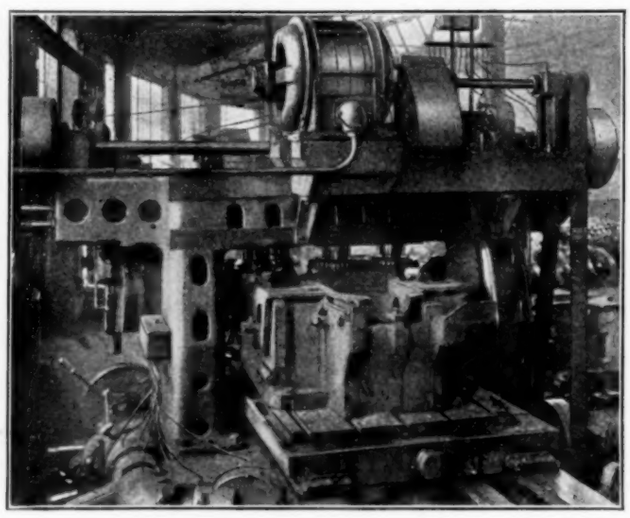
FIG. 25. TRANSMISSION ASSEMBLY

bronze and three cast-iron plates engaged through a linkage operating three dogs. Instead of the customary clutch foot-pedal with spring-operated releases, the control is by hand lever with positive action in both directions. Clutch-plate holes are drilled in a Harrington multiple-spindle drilling machine and most of the other machine operations on these parts are performed in Bullard vertical turret lathes.

The control arrangements of these big tractors look decidedly complicated to the layman as a separate lever is used to work each part instead of grouping the functions in one controller. This separation of controls might not work in a vehicle which traveled at high speeds but in these tortoise-gaited contrivances it answers very well.

As stated above one hand lever operates the clutch-shifting collar and permits the driver to fix his clutch in either "in" or "out" position. The master clutch is ordinarily used to start and stop the tractor, but in very bad going it is sometimes easier to get started by leaving the





FIGS. 26 AND 27. MILLING FIXTURES FOR GEAR CASES (FRONT AND REAR VIEWS)

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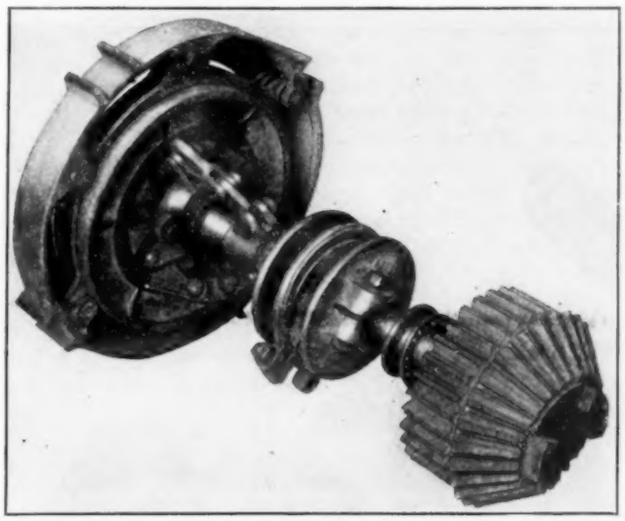


FIG. 28. MASTER CLUTCH ASSEMBLY

master clutch in and applying the power through the frictions previously described. This use of the transmitting units, while harder on the mechanism, increases the flywheel effect by adding the weight of the heavy friction wheels to the rotating mass and reduces the chances of stalling the engine. The frictions are controlled by separate levers so that either track can be driven independently to aid in turning the machine. Ordinary steering of the "75" and "120" is done by turning the front wheel by means of the steering wheel and column, but when the tractors get in bad places this method often becomes useless particularly if the front wheel leaves the ground as often happens when the surface is uneven or the pulling hard. Then the two friction levers are used to steer with and afford complete control.

In the smaller machines the front wheel is not used and the rather clumsy-looking frictions are replaced by steering clutches like the one shown in Fig. 29. These clutches are connected to the steering column so that they can be released independently by a small movement of the control handle and allow the driver to turn one of these machines in its own length with ease. This quick turning ability and the absence of wheels make the smaller caterpillars look like some queer kind of animal instead of a man-made vehicle and this impression is heightened when one of them gets in very uneven ground and starts climbing around where no self-respecting wheeled contrivance would ever go—and come back.

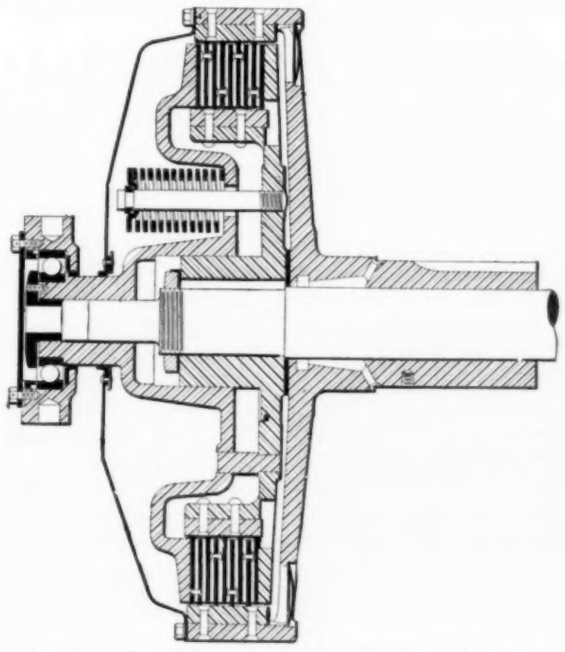


FIG. 29. STEERING CLUTCH OF 10-TON MODEL

The gears are shifted by means of a conventional shifting lever mounted on the transmission case cover which slides the dog clutches mentioned above. The remaining lever is equipped with a pawl and ratchet and works the single brake which is an asbestos-lined contracting band surrounding the plain friction wheel.

This all sounds rather complicated but it isn't so bad for the driver doesn't have to work anything with his feet and not more than two levers at any one time with his hands, wherein he has the advantage over the chauffeurs and organists.

The next article deals with the power plant of the 120-hp. tractor, one of the largest mobile gas engines built.

Machining and Testing a Large Transmission Case

BY FRED H. COLVIN

The transmission case of the Pierce-Arrow car presents a number of problems both in machining and inspection, as can be seen from an examination of the case itself as shown in Figs. 1 and 2. The work contains considerable boring and counterboring, all of which must be held within very close limits. This, as will be seen, involves drilling the small hole at *A* in line with the hole *B* Fig. 2, for which a special support is provided in the boring fixture at *A*, Fig. 3. This arm swings down inside the case and guides the drill

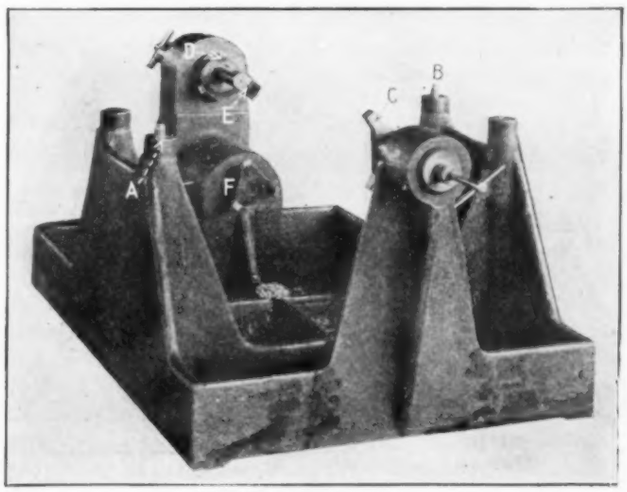
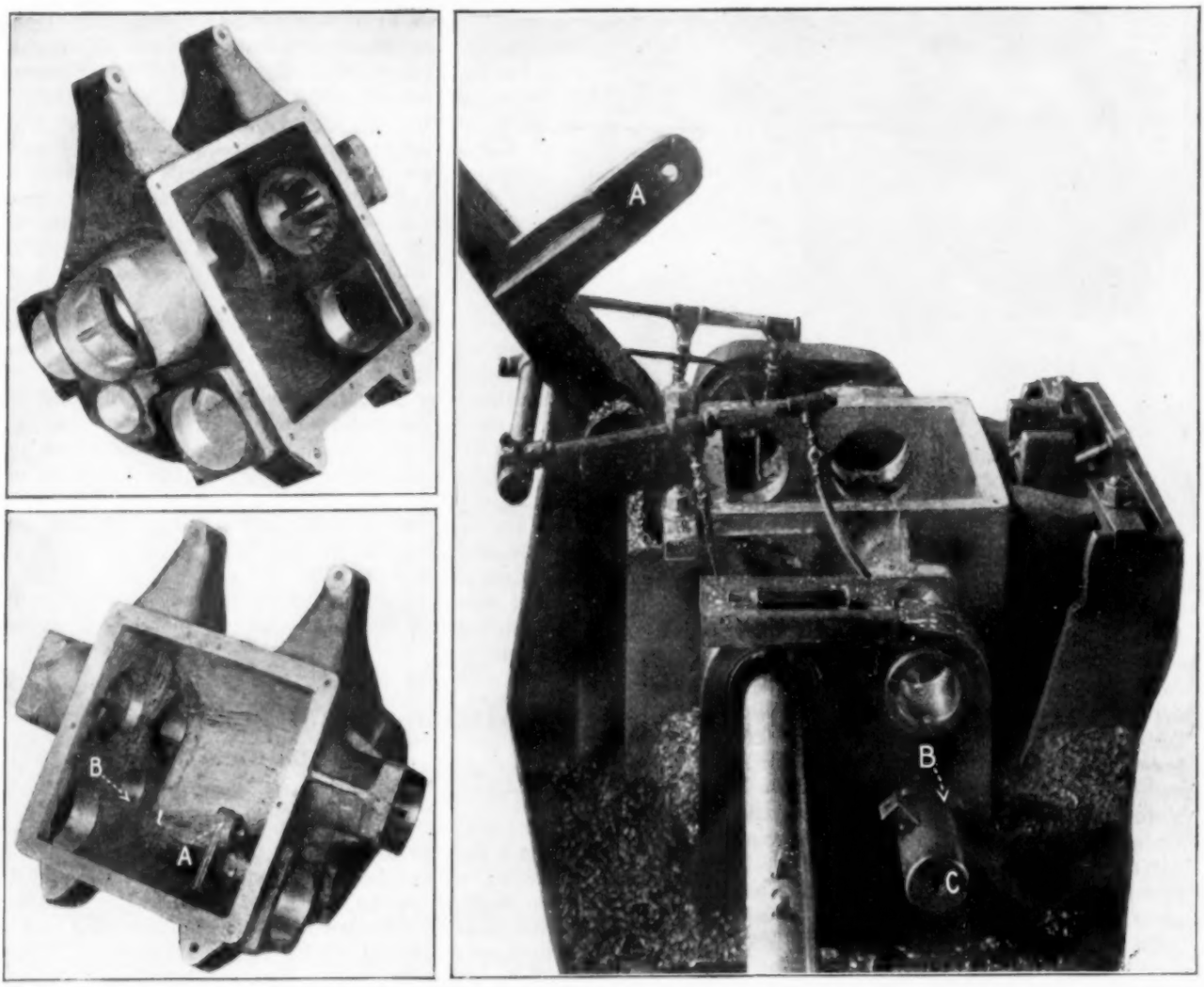


FIG. 4. THE FIXTURE FOR MEASURING COUNTERBORED HOLES

AUTOMOTIVE CONSTRUCTION



FIGS. 1, 2 AND 3. VIEWS OF TRANSMISSION CASE SHOWING PARTS TO BE MEASURED, AND HOW CASE IS BORED

which reaches in through the hole at *B*. The outer end of this hole is shown being faced by the bar *C*.

The fixture for testing the depth of the various counterbores is shown in Fig. 4, while Fig. 5 gives the essential details of this fixture and shows how the work is placed in it for inspection.

The transmission case is supported on the four uprights having two dowels *A* which must be within 0.002 in. of the same height and within 0.005 in. of the center line. When the case is placed in position, the depth of the various counterbores are measured by the plungers *C*, *D* and *F*, and the hook *E*, as can be seen in Fig. 5. The various measuring plungers are well supported also, and are easily used by means of the cross handles attached to the outer end in each case.

The measurements are determined by means of the

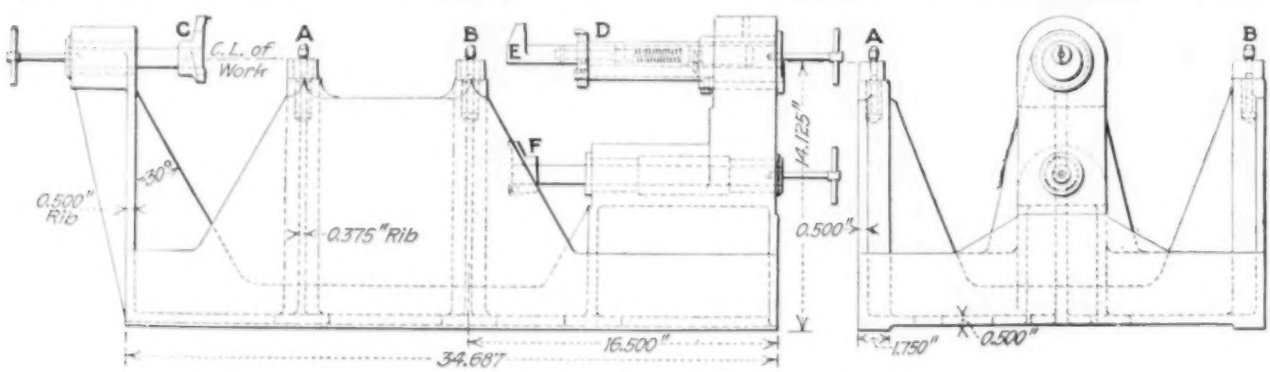


FIG. 5. DETAILS OF THE INSPECTION FIXTURE

AUTOMOTIVE CONSTRUCTION

very common form of "steel" gage in which one-half of the end of the plunger is ground down the amount of the tolerance between the high and low limit. In the case of the measuring surfaces *D* and *E*, it will be noted that both the inner and outer shoulders must be measured, the tolerance being a thousandth plus or minus.

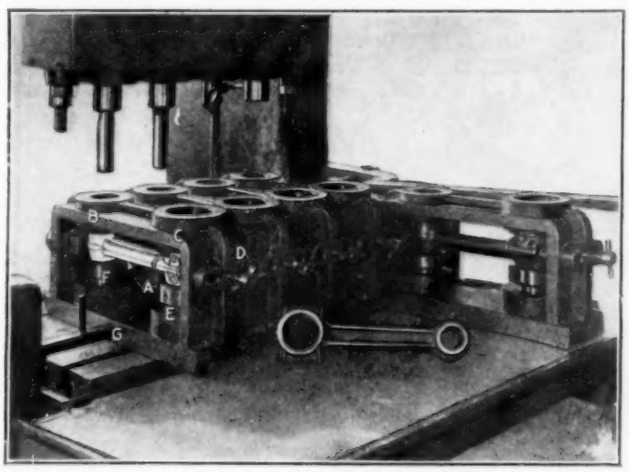
To accomplish this, the measuring plunger carries both the triangle *D* and the hook *E*, which are so located with regard to the center of the plunger that when swung down the point will clear the hole for insertion and removal. With the plunger pushed into place, the hook is then swung up into the position shown so that it not only gages the depth of the outer counterbore but also the distance between the two shoulders.

This makes a very substantial fixture and one which can be used easily and rapidly for work of this kind. It is the product of the tool designing department of the Pierce-Arrow Motor Car Co., Buffalo, N. Y.

Unusual Connecting-Rod Fixtures

By I. B. Rich

The Autocar Co. makes its connecting rods in the usual way, with the exception of a few operations. The rod itself is very substantial, as can be seen in the illustration, and the method of drilling the large and small



A METHOD OF USING SINGLE FIXTURES IN SEQUENCE

ends is somewhat unusual. Five connecting-rod fixtures are shown, four bunched together under the drilling spindle and the fifth removed to show how each one is handled independently of the rest. The rod *A* fits up against the under part of the bushings *B* and *C* while the screw *D* centers the rod by the two bosses and also clamps it before the drilling operation actually begins. The rod is held up against bushings *B* and *C* by means of the hollow jackscrews *E* and *F*.

A fixture with a rod in place is put under the right-hand spindle and the hole rough-drilled, this being the first operation. The fixture is then moved toward the left, and a second fixture put in its place under the first spindle. The rough-reaming of the first rod and the rough-drilling of the second rod takes place simultaneously during the next operation.

Then a third fixture is put in place and each of the others moved one position to the left. Here the first rod is finish-reamed, while the second is being rough-reamed and the third rough-drilled. In this way all the fixtures move down one place until they touch the stop *G*, which is the last position. After this the other end of the rod is bored the same way on an adjoining machine.

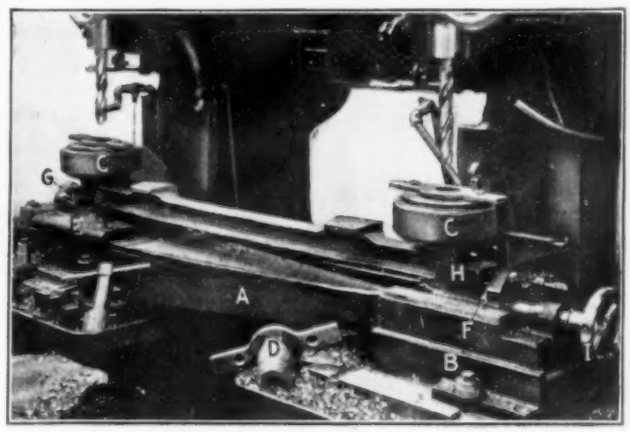
After the second end has been bored and reamed, the rods are removed and the empty fixture goes back to the starting point to receive another rod, which will then go through the same series of operations. These fixtures are easily handled, as they can be readily slid against the stop *G* after the end fixture is removed.

Drilling the Ends of Motor-Truck Axles

By Frank C. Hudson

The fixture used in drilling the ends of the front axle for a Pierce-Arrow truck is illustrated herewith. In this type of axle the yoke is made part of the steering knuckle, making the drilling of the axle an easier problem than when other designs are used. Two Colburn heavy-duty drilling machines are mounted side by side on a heavy bedplate with the spindle centers the proper distance apart. The drilling fixture consists primarily of the heavy bed plate *A* having one end bolted rigidly to the table of the machine at the left. The other end rests in the cradle *B* for convenience of construction.

The body of the fixture carries two heavy bushing supports, as can be seen at *CC*. These carry the drill



FIXTURE FOR DRILLING AXLE ENDS

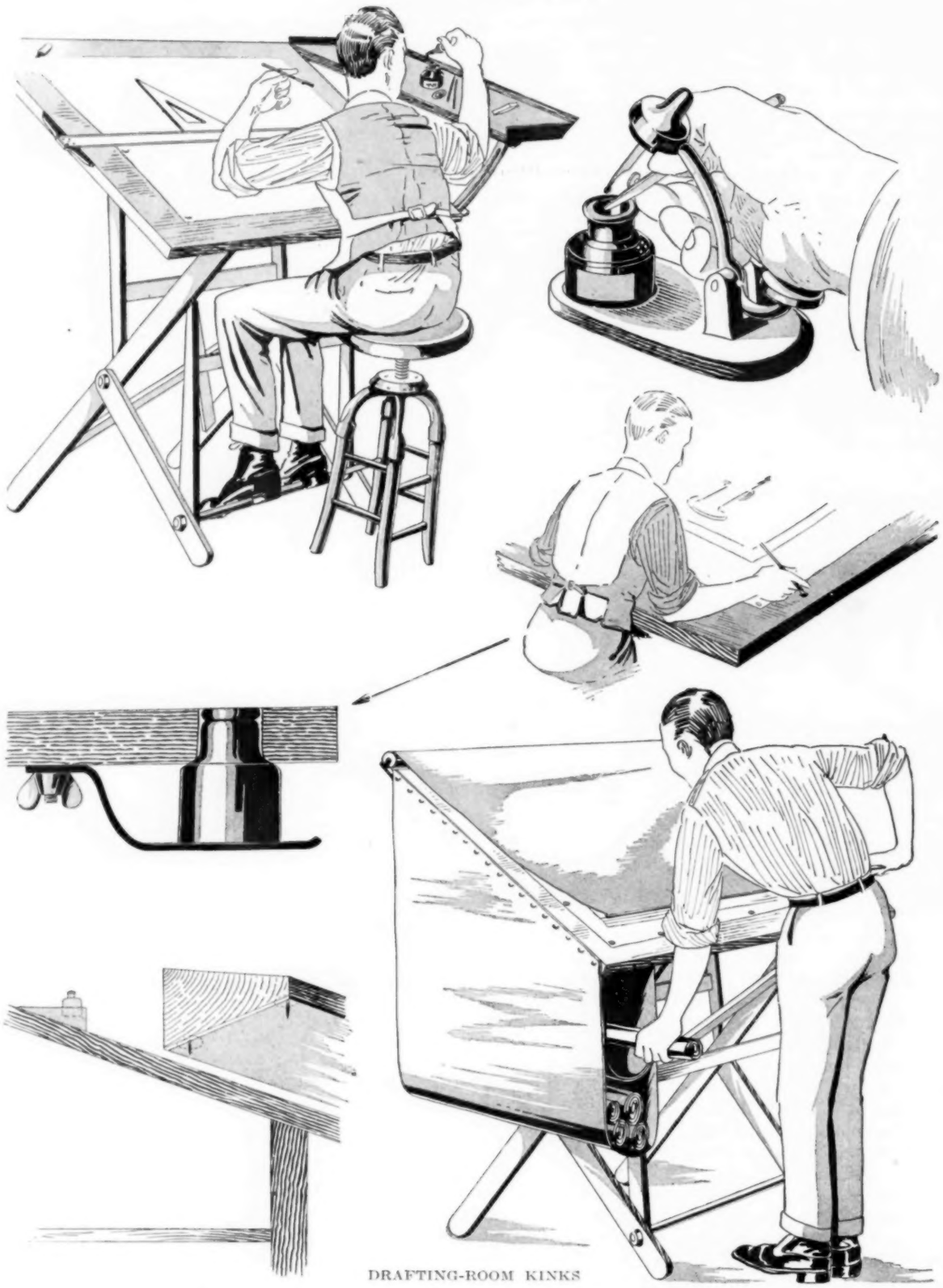
bushings or guides, which are removable, as seen at *D*, in order to allow for reaming at the same setting.

The clamping heads of the fixture *E* and *F* are both adjustable in order to compensate for permissible variations in axle forgings and to divide up any discrepancy instead of having it come all at one end.

The axle is located by two V-blocks *G* and *H*, the former being bolted to the block *C*, while the latter moves in a slide under control of the handle *I*. By this means the slide carrying the V-block can be readily moved so as to either clamp or release the end of the axle.

FOR SMALL SHOPS *and* ALL SHOPS

By J. A. Lucas



DRAFTING-ROOM KINKS

Contracts and Contractural Relations

(Part II—Continued)

By CHESLA C. SHERLOCK

WE HAVE already touched upon the matter of entering into contracts by mail. Insofar as they apply to acceptance of an offer by mail, there is not a great dispute among the courts as to the rules of law governing. It is agreed that a valid contract can be made by mail; that the offeror is deemed to be constantly repeating his offer until the offeree has had a reasonable time to reply to it and that unless the offeree avails himself of the opportunity to accept the offer within a reasonable time that he is deemed to have rejected the offer. When the offer provides that it shall be accepted by return mail, no acceptance is valid unless it is by return mail.

As in other instances, the offer stands, unless revoked before acceptance, for a reasonable time. Where it is limited, that limit is, of course, the measure of a "reasonable time."

The offeror has the right to revoke his offer at any time. The question naturally arises, where an offer has been accepted while a withdrawal is in the mails on the way to the offeree, which controls, the acceptance or the withdrawal?

When Acceptance by Mail Becomes Effective

Our courts have adopted the rule that acceptance by mail takes place as soon as the offeree has deposited his letter of acceptance in the post office and that unless the notice of withdrawal has reached him prior to this time, that he can hold the offeror to the terms of the contract. Unless the withdrawal of the offer reaches the offeree before he has mailed his acceptance, it has no more effect than if it had never been mailed.

It should be noted that it is immaterial whether the letter of acceptance ever reaches the offeror or not. All the offeree has to prove is the posting of the letter containing the acceptance. Much confusion and much litigation arises every year simply because business men suppose that it is necessary for the acceptance to reach the offeror to be binding upon him, or else are of the opinion that if acceptance takes place on the posting of the letter, that revocation also ought to be accomplished by the same method. It is impossible in this discussion to enter into all the complex situations which may arise in the acceptance of contracts. For that reason we are reducing to as short statements as possible the rules of law on each case and are refraining as much as possible from reference to the lengthy decisions contained in the reports. Where rules of law are practically uncontested, it is unnecessary to quote authorities.

Hence, while there are many situations which may arise in the case of offers and acceptance by mail, telegraph or telephone, we are passing them up. The general principles already mentioned apply in most cases.

Where contracts are agreed upon and the parties further agree to enter into a written contract, it is interesting to know whether the contract has already been made, or whether it is not completed until the matter has been reduced to writing and duly signed by the parties. This is a question which cannot be answered off hand, for its solution will depend largely upon the circumstances surrounding each case.

Where the contract has, to all intents and purposes, been entered into but is to be reduced to writing merely for the convenience of the parties, it is formed at the time the meeting of the minds of the parties occurred; if it is agreed to sign a contract in writing at some future time along certain lines agreed upon and it is evident from the action of the parties that they do not contemplate the contract as being yet in existence, then it does not arise until the written instrument is signed.

The Completion of the Contract

And one of the most important things in the whole law of contracts is to know just when the contract was completed. This is particularly valuable to business men, for oftentimes they imagine that valuable contracts have been completed when, in point of fact, they have not been completed at all and will not be until the parties get together at some future date. In the interval, the other party changes his mind, denies that he entered into a contract and our business man loses a valuable contract besides involving himself in expensive litigation.

Even though both parties may in fact agree to the matter, there is no contract where there has been a mutual mistake of fact as to what the subject matter of the contract was. Where the parties honestly believe that they are entering into a contract about machinery, for instance, when as a matter of fact they are entering into a contract about raw materials, there can be no valid contract because there was no meeting of the minds upon the matter.

A mistake of fact will not always avoid a contract even where it has been honest on the part of the parties. It must be a material fact, one going to the root of the whole agreement in order to have this effect, for the courts are not disposed to aid in the search for flaws to avoid a contract, and they would rather abide by the expressed terms of the written instrument, as evidence of the true intention of the parties, than to speculate on side issues. But where there has plainly been a mistake of fact material to the agreement, the contract will be set aside.

An example of this class of contracts may be given where there is a mistake of fact as to the existence of the subject matter of the contract. The parties may contract about a certain lot of second-hand machinery, but the machinery may even then be in the process of being destroyed by fire. In such case, there is no contract.

In the case of a unilateral mistake of fact, however, the contract is not avoided. Where one party makes a mistake, while the other party has acted in perfect good faith and innocence, the contract is not void, but in full force and effect on the part of the parties, except where it amounts to an injustice to the one making the error, according to the rule in some jurisdictions.

Since a meeting of the minds of the parties is essen-

tial to the validity of all contracts, the signing of a contract, in the belief that it is something else, renders the contract so signed null and void. There has been no meeting of the minds in agreement in this case. But where one, having the capacity to read and inform himself as to the subject matter of an instrument in which he is signing, where the contents have not been misrepresented to him, the courts are almost unanimous in saying that he cannot be relieved from liability for signing a contract without first taking the opportunity to discover what he was doing.

Oral Testimony

If it were possible for parties to a contract, when sued for nonperformance, to testify that they signed the contract but to add that it did not express their intention, or that it was something absolutely different from what they thought it was, it would destroy the value of all contracts. Thus, we have a rule of law which absolutely prohibits the introduction of oral testimony to vary the terms of a written instrument. And furthermore, the instrument itself is deemed to be the best evidence of what the agreement between the parties was.

This, of course, is subject to some modification in a court of equity, but we will consider that matter later in the discussion.

Mistakes of law, in the making of contracts, are not sufficient to permit a party to avoid his portion of the agreement. Generally, an instance is given where the facts are thoroughly understood but the party makes a mistake as to the legal effect of the agreement.

Contracts, in order to be enforced, must be definite or certain as to the terms. Unless the terms can be understood or ascertained by the courts, they will not attempt to enter into a puzzle-solving contest, but will declare the contract of no effect for want of certainty.

Contracts of Service

In Massachusetts, it has been said that a contract of service must be certain and definite as to the nature of the service to be performed, the place where and the person to whom it is to be rendered, and the compensation to be paid, or it will not be enforced.

It does not mean, however, that the courts will make no attempt to ascertain the intention of the parties merely because it is difficult to do so In fact, if it is at all possible to do so, the courts will discover that intention and apply it, for they are becoming more and more anxious not to destroy contracts for mere uncertainty, if it is at all possible to preserve them.

There must be a valid consideration to every contract. This rule is so general as to need slight comment. The purpose of the rule is clearly to prevent the enforcement of gratuitous promises. It has been pointed out that if one receives such a promise and it is broken, that he is no worse off than before. But where a promise has been given, in consideration of a certain act or omission on the part of the other, there is something lost in case the promise is broken, and the courts are organized for the very purpose of preventing men taking advantage of others when it suits their convenience to do so.

Consideration is generally expressed in money terms as being the price paid to obtain the promise from the promissor. But it need not consist of money alone. It may, in cases of conveyances, be simply "love and affection," or it may amount to no expressed consideration in other similar agreements. It may consist of the doing of something which one is not legally bound to do. It does not, however, consist of performing a duty which one is required by law to perform. It may amount to a relinquishment of a right; or the performance of a moral obligation, or a forbearance to sue upon an obligation already owing. Consideration may consist of numberless items, almost, but the points named will cover practically the entire list of possibilities.

Of course, the consideration must be adequate and fairly well be worth the value of the promise given by the other party, although the courts will not attempt to set themselves up as judges of values. But where the consideration is plainly inadequate, a presumption of fraud arises which it is hard to overcome.

Where there is a want of consideration or a failure of consideration, the promissor has a right to show this in defense of his failure to perform his part of the agreement. Failure of consideration will not. however, affect a negotiable instrument in the hands of a bona fide holder for value, nor does it affect contracts under seal.

Mutuality in Contracts

We have already considered to some extent the necessity of mutuality in contracts in order to make them valid and enforceable. It is not necessary that mutuality extend to the point of making it possible for each party to sue one or the other as the case may be; but where mutuality refers to cases where there must be a promise on one side and a valid consideration on the other, there is no doubt before the authorities but what it must be present in every contract. One authority has said that it appears more to be another way of stating the rule that mutual promises are adequate considerations for each other.

So far in our discussion of the elements of business contracts, we have found that assent or agreement is probably the most important element.

This presupposes the existence of parties capable of entering into an agreement. It supposes that they are of sound mind and not physically or otherwise legally incapacitated from entering into an agreement.

Summary of Conditions

We found that the agreement must be certain and definite as to the subject matter, the parties, and the manner in which the promise is to be executed. We found that there must ordinarily be an offer and an acceptance of that offer, in order to evidence the assent of the parties to the agreement.

We found that the offer may limit the time or manner in which it is to be accepted and that in accepting it, the offeree had a reasonable time in which to signify his acceptance.

We found that as soon as the acceptance was posted in the mails that it constituted acceptance of the offer, provided notice of withdrawal had not reached the offeree prior to that time.

We found that there must be a consideration for every promise sufficient to become the subject matter of a contract. We found that this consideration may take the form of money, or a desire to show love and affection, or a forbearance to bring suit, or a number of other things entailing loss or gain. We also found

that where there is a failure of the consideration or a want of it, that in the majority of cases, the contract fails with the consideration.

In our next discussion we will take up the legality of contracts and their interpretation. This should be the most interesting and value of all to business men generally.

Industrial Brazil

By Ernest L. Little

Brazil, sometimes referred to as "the greatest storehouse" of raw materials in the world, has, during the four years of European war, passed through a period of industrial development that will lift her to a plane with the world's manufacturing nations. The demand on the part of the belligerent countries for foodstuffs and raw materials has stimulated agricultural and industrial production far in excess of pre-war years.

Brazilian factories have undergone a tremendous development and in the State of Sao Paulo alone, 323 new industrial enterprises have been established. This construction of new enterprises has had the favorable assistance of both the federal and state governments, special privileges having been granted to industries for the manufacture of caustic soda and to the iron, steel and coal-mining industries.

The most important expansion since the war has been the steady building up of the textile industry. Brazil, previous to the war, had become an important producer of raw cotton for export, but with the marked growth of this industry which now produces fully 75 per cent of the cloth consumption, the export of the raw material has materially decreased. This successful development of the textile industry offers an unusual opportunity for the manufacturers of textile machinery to market their products in Brazil.

In the shoemaking industry, there are several large factories in Sao Paulo and Rio de Janeiro, and with the further extension of the local tanneries which are now turning out leather in many grades equal in quality and lower in price than the imported product, it is stated that Brazil is being shod with Brazilian shoes.

There are also several large furniture factories turning out beautiful furniture made with the native hardwoods. There is a factory specializing in wicker furniture, which is becoming very popular.

Not only are cotton goods being produced, but the native hats are now worn, as are shirts, collars, underwear and hosiery.

A sudden business awakening has also taken place in metal-working industries. Brazilian farmers are now using agricultural machinery manufactured locally, especially rice-hulling and rice-cleaning machines and the various tools used on the coffee plantations. Sugar machinery, pumps and corn grinding machines are also included in the agricultural implement list. In Sao Paulo horseshoes, plumbing goods, chains, screws and nails, locks and wire netting are made to supply the home demand.

Brazil is also one of the richest countries of the world in iron ores, which are found in great quantities in several of the states. The ore is usually an oxide of iron and a large portion is stated to be 50 to 70 per cent pure iron. Some capital has been invested in this industry and there are several large works. It is merely a question of time before the ore deposits will be extensively worked.

The hoped-for discoveries of coal have not been made to any extent and consequently Brazilian industries cannot depend on native production for power. However, the mountainous nature of the country furnishes abundant water power, only a part of which has been utilized. The development of this source of power will assist in the solution of the power problem and will aid materially in the industrial expansion of the country.

This sudden awakening of industry in Brazil has provided a new market for American tools and machinery. Owing to the favorable attitude of the government and the financial success of these new industries, continuous growth is assured, thus providing a steady demand for machine equipment.

The method to be followed by the American manufacturer in marketing his machinery in Brazil depends upon his export policy. There are two general methods to be followed in export trade, indirect and direct. By indirect exporting, the manufacturer appoints a commission or export house in this country to act as his representative, accepting such business as his representative is able to develop and receiving payment for the merchandise in the United States.

The Direct Method of Exporting

The direct method is generally followed when a serious attempt is to be made for export trade. This consists of either securing a native house in Brazil to act as agent or by the establishment of a branch house.

The opportunity presented by the Brazilian market to the American manufacturer of machinery depends to a very great extent upon his ability to secure satisfactory and permanent connections with a Brazilian house. Such connections constitute, in fact, the important factor in the success or failure of any manufacturer who is endeavoring to enter this market.

The manufacturer, desiring to place his line of machinery with an agent in Brazil, must be certain that the house to which he intrusts his business is well represented in each of the commercial districts of the country. To secure adequate representation in Brazil it is necessary to grant the agency to a company that has commercial travelers or sub-agents who cover the entire republic. In the North are the cities of Para and Manaos—of considerable commercial importance. In the South the industrial centers are Rio de Janeiro and Sao Paulo. Since it takes about three weeks' journey to reach Manaos from Rio, it obviously is of vital importance to take this into consideration when granting the agency. If, however, it is not possible to obtain as an agent a company with facilities to cover the entire country, agencies should be given for each commercial district to separate companies.

The establishment of branch houses should depend upon the amount of business to be obtained. Owing to the expense that would be incurred in an undertaking of this character, careful consideration of the future possibilities of the market should be made before taking this step.

The question of credit in Brazil is not difficult providing the agent is of sufficient financial standing and responsibility. In order to clear merchandise through the Brazilian custom house it frequently takes from 30 to 60 days and to secure a large volume of business, credit will have to be extended for that period, usually for 60 to 90 days, as the importer desires to place the merchandise on display before payment.

When making shipments of machinery to Brazil great care should be taken to inclose direction sheets and repair lists in the Portuguese language. This direction sheet should contain a list of every part entering into the construction of the machine and if possible an illustration of each part. In case the machine is shipped knocked-down, instructions for assembling and installation for operation should be added.

The immediate opportunity offered by the industrial expansion of Brazil presents an unusually attractive market for American manufacturers of hardware and machine equipment to merchandise their products. By conforming with the requirements of the Brazilian market, together with the superiority of the American products, no difficulty will be experienced in competing with European manufacturers.

Lead Laps for Internal Lapping

By W. H. Sawtelle

While the lead lap is an old device for finishing holes requiring extreme accuracy and at the same time a smooth surface, the article by Hugo F. Pusep on page 712 of the *American Machinist* raises the question as to whether its many advantages are not being lost sight of. He advocates the "conventional type of lap—a split cylindrical brass or cast-iron bushing driven on a tapered arbor."

In the experience of the writer, much expense in first cost and valuable time in obtaining results have been saved by using laps made from lead. These are made by molding the lead on taper mandrels which have grooves milled on one side with a half-round cutter. Split iron coreboxes make ideal molds for this purpose when they can be obtained in standard sizes and molds of wood can be made quickly for emergency jobs.

The closed end of the mold is reamed to fit the large end of the mandrel which should have a suitable length left straight and finished to a standard size. The blacksmith's helper or a handy man should keep a number of these laps in stock in the tool crib, as obviously any number can be molded on one mandrel.

In turning the lap to size, use a round-nose tool and all the speed of which the lathe is capable. There is no danger of running it too fast. Allow enough freedom in fitting the lap to the work to charge in the abrasive; the lap will easily build up 0.002 to 0.004 in. when charged.

When turned to size the lap should have clearance grooves cut in it by running the lathe slowly, and traversing the tool quickly across the surface of the lap, allowing the tool to cut both ways and make helical grooves which serve to catch the loose emery and chips, thus preventing the lap from loading.

This type of lap with its diamond-shaped lands well charged with No. 90 emery becomes a real cutting tool, the only objection to which might be in the case of a concern working on a cost-plus basis; they might figure that not enough time would be consumed.

Rolling the lap in emery, slightly flattening it with a flat-faced hammer or splitting the whole length in order that the mandrel may be driven further in, are all methods of enlarging it which are available with this type of lap and each may be used according to requirements.

On the more particular class of work a mandrel as large as practical used in connection with the split lap, will be found by far the best as it can be kept to size and the whole length will cut. Small laps for jig bushings and similar work may be molded solid. A mold for several sizes can be made from two cast-iron plates planed and doweled together, the required sizes of holes being drilled nearly through on the parting line.

A good alloy for small laps is composed of ½ oz. bizmuth, 1 oz. antimony, 13 oz. tin, and 1½ oz. lead. This alloy is stiff enough to be held in chuck while being turned to size, and ductile enough to stand spreading with the hammer when just a little increase in size is needed.

Cast-iron and bronze bushings may be safely finished with lead laps and emery, obtaining a surface which, when used in connection with a hardened, ground and lapped spindle, is practically wear proof.

Having the opportunity to study the action of such bearings in actual service covering a period of more than 20 years, the writer is firmly convinced that no emery is left that will cause trouble. Some of these bearings have been in use all of this time and are still in excellent condition.

A Dozen Kinks for the Machine Shop

By A. R. Durant

I have found that:

Soft-steel arbors do not ruck up when driven into cast-iron or steel work if both arbor and hole are previously smeared with red lead.

Points of scribers and other small tools are easily hardened by heating to cherry red and plunging into a soft piece of soap.

Beeswax as a lubricant for a tail center is superior to oil, hard grease, red lead or chalk.

Large holes may be bored clear through sheet brass or steel with a twist drill by clamping a piece of hardwood board on either side and drilling through the whole.

Small dies, etc., can be tempered to a light straw color if heated to the point of just fusing wire solder before quenching.

In case of a stuck arbor or shaft, allow turpentine to penetrate thoroughly before attempting to drive out.

Minute cracks in hardened pieces are easily located if the work is oiled, wiped off and then chalked. The oil remaining in the cracks quickly shows up by soaking through the chalk.

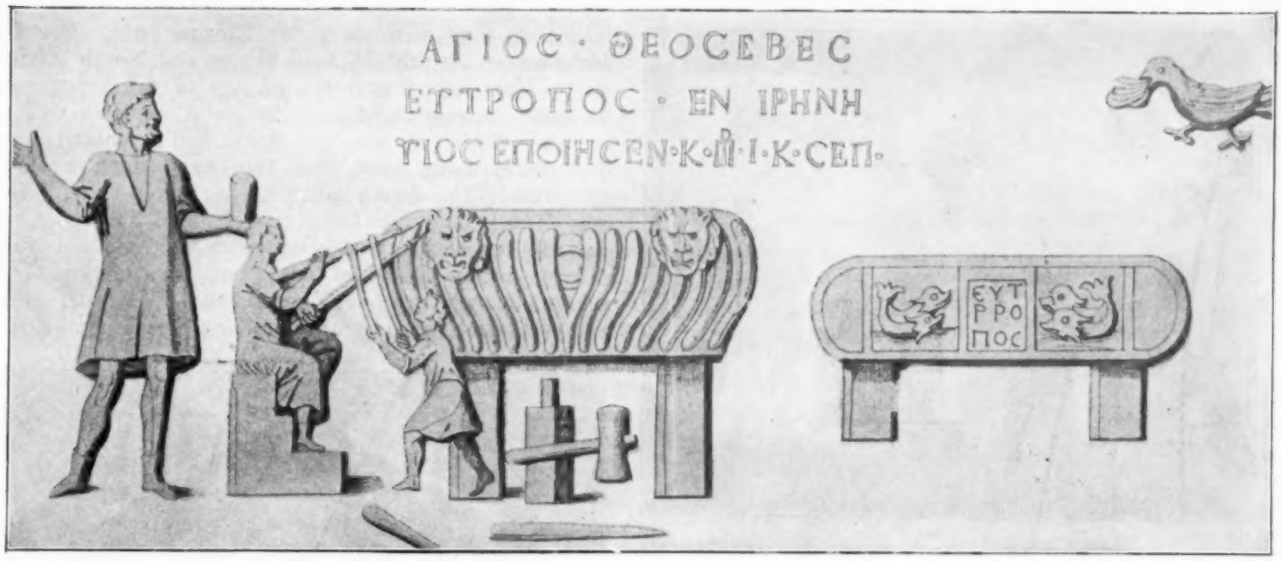
Small left-hand or special taps for odd jobs are cheaply made by chasing a thread of the required pitch on a piece of drill rod in a lathe. The flutes are formed by filing the threaded portion three-cornered and the end is given a good taper for starting.

To do a good job of brazing, immerse, or thoroughly wet, the work in a saturated solution of borax and hot water. While heating, apply powdered borax freely.

When grinding in a lathe, a small pan or tray of water placed on the cross-slide and under the grinding wheel is most efficient for catching the sparks and emery dust.

In casehardening for colors, using cyanide, the work is often overheated. A bare red heat is sufficient for a good mottled appearance.

Heavy sheet brass may be quickly reduced to paper thickness—for thin gaskets, shims, etc.—by dipping repeatedly, for a few seconds, in nitric acid and then in water, until the correct thickness is obtained.



The Evolution of the Workshop—III

By H. H. MANCHESTER

Of the discoveries and inventions which have had a marked influence on subsequent industrial development, the introduction of horseshoes, the invention of files and the organization of trade guilds are among the most prominent. The advent of these belongs to the Middle Ages. (Part II appeared in our Jan. 15, 1920, issue.)

AFTER the Roman Empire was overrun by the barbarians, the old organization of industry, as it had been carried out by slaves and freed men, was broken up. Commerce between far distant countries, which had been common under Roman rule, came to an end, and each city and district was compelled to depend almost entirely upon its own resources for manufactured necessities.

In addition to this, the records of industry become almost negligible for several centuries, and it becomes a difficult matter to grasp the exact conditions of the period. In comparing the metalworkers' shop as it existed in Roman times with those of the later Middle Ages and early modern period, many changes will be seen. Even in the so-called Dark Ages important improvements had been made, but they can be assigned to no definite inventor or exact date. Practically all that can be done is to chronicle the first notice of their appearance.

FIG. 12. ANGLO-SAXON FORGE SHOP ABOUT 900 A.D.

The introduction of iron shoes for horses had a marked influence on the development of the workshop. The Greeks and Romans of the early Empire had occasionally used, for horses and asses, sandals which were tied on the feet. However, during the last centuries of the Empire, shoes that were nailed on were introduced; evidence of this having been found, to some extent, in the later Roman remains. Their use greatly increased the demand for workers in iron and made smithies far more common than before.

The pictures of the so-called Dark Ages that represent workshops may be counted upon one's fingers. Two very crude wood carvings in the church at Hillestad show what is apparently the working of soft metal. However, an Anglo-Saxon picture, Fig. 12, of perhaps the 9th century illustrates two smiths working at a furnace. It is to be noted that the tongs have become round and the hammer long and slender. The old Norse description of Wayland, the smith, describes how in making the charmed sword he improved its temper by filing it into pieces and reforging it, and mentions the furnace, forge, hammer, files and other tools common to Roman times.

Probably the best idea of the workshop of the 11th century is to be gained from the "Diversarium Artium Schedula" (Schedule of the Various Arts) of Theophilus. He describes how the workshop should be divided into different parts to correspond to the work in different metals, for it must be remembered that the smiths still worked in more than one material. He gives simple instructions concerning

FIG. 13. AN ANGLO-SAXON SMITH OF THE 13TH CENTURY

the work bench, furnace, bellows, handles, tongs, hammers and files. The bellows were still of the hand variety; the files were flat, three cornered, round and hollow. He also notes the tools required for hollowing, scraping, engraving, cutting and key-making, and the simple hand methods employed in these operations.

Wire Drawing

The first account of wire drawing was also made by Theophilus. The method described by him, which was used by St. Eligius in the first half of the 7th century, consisted of drawing the wire through holes of various sizes in a steel plate by main strength, aided only by a pair of pinchers. The holes are graduated in size so that the wire could be made a little smaller with each drawing.

Another interesting device described by Theophilus, was used in beating out beads of soft metal. It consisted of two plates, fitted one over the other, with hollows in them corresponding to the size of the bead. The metal to be formed was placed in the hollows, and the plates pounded with a horn mallet. This was essentially the forerunner of die-stamping, though, of course, single dies for the stamping of coins had been used for many centuries. Theophilus also treated of chasing, engraving, repoussé work, studding, soldering, niello, and casting.

During all of the centuries which are often somewhat opprobriously termed the Dark Ages, it must be realized that they were dark for Europe only. For the Mohammedan world of Asia Minor and North Africa, on the contrary, they mark an age of great progress. This development held good in metal work as well as in other fields. Greece and Rome had remained users of bronze, using steel only for sharp-edged weapons and tools. The Arabs adopted the Wootz steel, which was already made in India, and from it fashioned not only the famous blades of Damascus and Toledo, but defensive armor which no bolt from the crossbow could pierce. There are many specimens of Arabic metal work in existence, but unfortunately the Mohammedan

FIG. 14. LATHE OF 13TH CENTURY, FROM A WINDOW IN THE CATHEDRAL AT CHARTRES, FRANCE

FIG. 15. GIOTTO'S BAS-RELIEF OF A SMITH IN THE CAMPANILE AT FLORENCE, ITALY

religion forbade its followers from depicting the human form, and for this reason we have no Arabic figures of workshops or any showing the methods used by the scimitar maker.

The crusades, which began in 1096, increased the intercourse between western Europe and the Greek Empire at Constantinople and the Arabs. These wars spread the knowledge of many things throughout Europe and forced the Western knights to adopt the better steel of their foes for weapons and armor. At the same time the demand in Europe for the work of armorers and farriers greatly increased, and from this time on the pictures and other records concerning the metal industries become more common.

In olden Greece and Rome, as has been already mentioned, the work was done by slaves and freed slaves. After the fall of the Roman Empire, slavery continued to some extent, but there grew up, especially under the feudal system, the institution of serfdom under which the workman was bound to the lord and to the domain. During the crusades, however, the development of industry in the cities gave rise to skilled craftsmen, who partly for mutual advantage and protection, and partly

to buy off the services due from themselves and the towns to the overlord, formed associations or guilds. These differed widely from any present association. The guild included both the masters and workmen in a trade. It had no connection with any similar industry in another city, but in many places took part with the other guilds in the government of the town, and in some notable cities, such as Florence, the guilds were in fact the only governing agency. Each guild had a monopoly of the manufacture and trade in its own line in the city, and in return owed certain duties to the city.

Each master workman or shop owner might have under him both apprentices and journeymen. The apprentice was usually bound to him when a boy, and was required to spend at least seven years before he completed his apprenticeship, during which time he received board and clothing and a few dollars a year as wages. After his apprenticeship he became a journeyman for three years or longer. During this time he received the wages prevalent in the craft, and was permitted or expected to journey to different cities in order to learn new methods of the trade. Before becoming a master he was expected to prove his efficiency by producing a so-called masterpiece, and to pay a considerable sum into the treasury of the guild. While conditions under the guild were far better than under the slave system of the classic period, they were still far from ideal. The journeyman shop worker of 1300 worked from dawn until dark, and for this received about 40 cents a week for a six-day week.

There are several 13th century illustrations of workshops or parts of workshops which are very interesting, although only a few of them illustrate any advance from the classic period. An English blacksmith of the 13th century who was pictured in Strutt's book on "English Dress" is using only the hammer and tongs. A reproduction of this picture is shown in Fig. 13. Further evidence of the kinds of tools used is shown in another illustration found in the "Weltchronik" of Rudolf von Ems about 1254. Here again only the hammers and tongs are used. One of the windows in the Cathedral of Chartres, however, is a good picture of a farrier shoeing a horse, which is probably the oldest extant representation of this operation.

One of the unsolved problems in the history of technology is the date and manner of the introduction of the various machines which we find in use at the beginning of the Modern Age. One of these machines was the lathe. The Romans probably had no machine tools which could be properly designated under this name, although they had a method of using a bow to turn a drill placed horizontally. Philo of Byzantium mentioned that a cylinder for a pump could be bored out in this way, and there is a broken sketch of such an arrangement on a tomb of the Empire period. Moreover, Oribasius about 362 A. D. suggested that one might cut screws by using a bow to turn the work. Thus, it can be seen that something approximating the lathe was in contemplation, although it will be noted that the work was still to be turned by one hand while the tool was held by the other.

For this reason one of the windows in the Cathedral at Chartres, Fig. 14, is of the highest historic importance. It represents a workman who is unquestionably turning a lathe by means of a treadle and holding a tool against the material with his hands. The machine and operation are both of the simplest sort, and were probably applied only to wood, or if to metal at all, only to the softer varieties. The picture is probably the oldest illustration of a lathe run by foot power, and as such is well worthy of reproduction.

In other fields we discover that at this time attempts were being made to develop some sort of machine to take the place of slave labor. While these do not apply to the machine shop, it should be noted that one Villard de Honnecourt devised a saw, the running of which was assisted by the spring of a bent sapling, and also a saw so arranged as to cut piles under water. At the end of the 13th century the Arabs were using the water-wheel to furnish power for the crushing of sugar cane, but the extension of this power to other lines did not come until later. An illustration, Fig. 15, of the metal workshop is found in one of the panels, by Giotto, in the Campanile at Florence. While this is supposed to represent Tubal Cain, it is like all other examples of medieval art representing the conditions existing at the time of the artist. An interesting picture of a workshop is that shown in a manuscript which dates from the beginning of the 13th century, and is now found in the British museum. As reproduced in Fig. 16 it depicts a style of forge with a canopy top and, which is more important, it shows the application of the lever to the bellows. In the picture it is apparently being worked by a man behind the forge.

FIG. 16. WOMEN AT A FORGE IN ENGLAND, ABOUT 1338 A.D.

Another very strange peculiarity in the picture is that the workers forging the iron are women, which

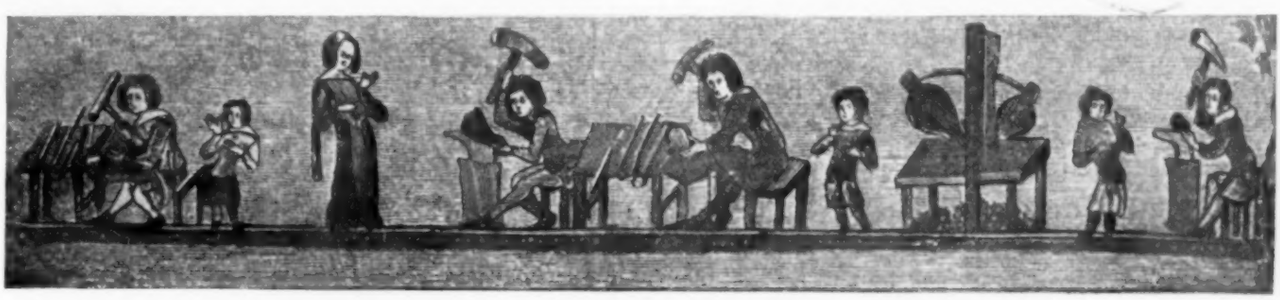


FIG. 17. THE SHOP OF EARLY ENGLISH TOOLMAKERS

suggests that the entrance of women into the shops during the recent war was not an unknown innovation.

Another interesting picture of this period is shown in Fig. 17. This shows the shop of an English toolmaker and portrays, without a doubt, the forging and cutting of files. It will be noted that the file cutter's hammers and methods of cutting the files do not differ to any great extent from those employed today. After the 14th century, however, the development of the workshop took place more rapidly, which together with the 15th century will be covered in a subsequent article.

More Advice to Inventors

By E. H. Michaelis
Consulting Mechanical Engineer

Many of my clients ask me this question: "Shall I first make an application for a patent to protect my invention or shall I go ahead and make a working model of it?" I always advise them to protect their idea first and then go ahead with experimental work. It often takes a lot of time and work to develop an invention far enough to be of real practical use, and it is always possible that somebody else may have the same idea and get ahead of you. Your patent, if drawn right, will protect your invention even if you change your construction in the course of reducing your idea to practice.

The reduction to practice can be done either by making drawings and developing the invention on paper or by starting to build a model and changing this model around until it meets with your approval or has to be thrown away and a new one started.

Many inventors are under the impression that it is necessary to have a model in order to apply for a patent. If they would write to the Commissioner of Patents, Washington, D. C., for a booklet issued by the U. S. Patent Office entitled "Rules of Practice in the U. S. Patent Office" and furnished free of charge on application, they would find that only drawings are needed and that the Patent Office will ask for a model only in case the examiner deems one necessary to demonstrate the practicability of the invention, or if the invention is so complicated that it is necessary to have a model to understand it. All the inventor needs before making application for letters patent is either a rough sketch or a crude model and the ability to describe his invention to his attorney so that the latter can work out the application intelligently.

Now to come back to the question as to which is the better way to do your experimental work—on paper or in the shop by building a model. The answer depends on circumstances. If the inventor has mechanical ability, knows pretty well what he wants to build and has the facilities, it is possibly better to build a model and try it out. If it does not work, it will be easy to find what has to be changed in order to get the right results. But this way has quite a few drawbacks, especially if the inventor can not do his own work and can only spend a part of his time in the shop where his work is done. He has then to tell the man in charge what he wants and must depend on him to have the work done right. When things go wrong he will have to pay for the time at $1.25 an hour, and also for the material used and which has to be thrown away. In many cases it will be necessary to have patterns made and pattern work runs into money, as anybody who ever paid for it will tell you. If things in the shop do not work out right, the patterns will either have to be changed or new ones made.

Nobody would try to build a barn without making a layout from which to get the necessary list of material, length and sizes of uprights, sleepers, etc., but many will try to build a new mechanical device without layout or specification for the simple reason that they feel it costs too much to have a set of drawings made. If they would look a little deeper into this matter they would find that money spent for experimental work on paper does save money for the inventor.

If the inventor will employ a competent engineer to do his work, he will have nothing to pay for but the time spent on his work which at present rates is usually $1.50 per hour. Changes which in the shop would mean a lot of money for material which could not be used again for new patterns can be made on the drawings with the help of an eraser, or if the changes should be very radical, all the material wasted would be some paper which would cost very little.

After the drawings are finished to the satisfaction of the inventor it will be easy to get competitive prices on the patterns, the castings from the patterns and on the machine work, while without the drawings it will be found impossible to get the work done on any other basis than the hourly price.

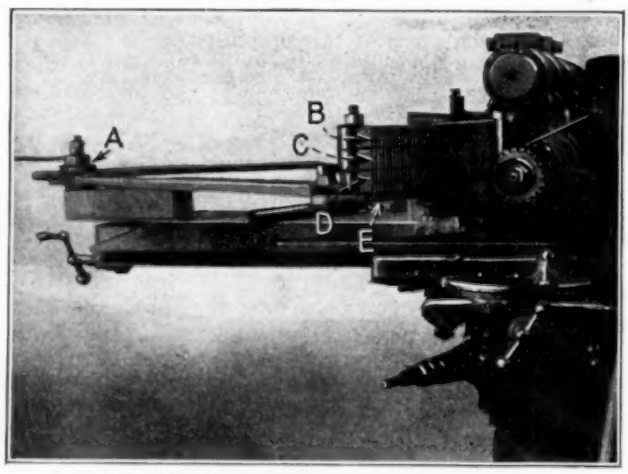
Notching Locomotive Quadrants

By John Martin

Notches for controlling the link positions on locomotives must be so spaced that the valves will cut off at a certain part of the stroke when the lever latch is dropped into any particular notch.

The illustration shows a device, for indexing quadrants for notching, in use in the Chicago shops of the Chicago and Northwestern R.R.

Three quadrants to be cut and a master quadrant for spacing are held in a bar-iron frame pivoted on the milling-machine table at *A*. Three quadrants, *B*, *C* and *D*, are notched at the same setting, the positions of the notches being located by the master quadrant *E*



NOTCHING LOCOMOTIVE QUADRANTS

which is locked in position by a locking pin on the milling-machine table, but not visible in the illustration. Spacing is done while the work is lowered so as to clear the milling cutter, and the notches are cut by elevating the milling-machine knee.

US
ARMY ORDNANCE NEWS

The Manufacture of Artillery Range Finders—II

By GEORGE H. THOMAS

In this article, which is the second of the series, the tools, jigs, fixtures and manufacturing methods as employed by the leading French and American range-finder manufacturers are compared.

(Part I appeared on page 1045, Vol. 51.)

MOST of the devices and methods employed in the manufacture of range finders and gun sights are the result of considerable study and experiment. It is rare that we have an opportunity to compare the foreign and domestic manufacturing methods as employed in similar lines and in this respect the practice of the leading French manufacturers and that of Slocum, Avram & Slocum are presented. Many of the devices employed were improvised under adverse and rush conditions to equal foreign production on established lines.

The French quadrant sight is distinctly an instrument of precision and up to a certain point it can be built on an interchangeable-part basis as will be shown later on. It will be seen from the drawing of the body, Fig. 8, that the part is very irregular in shape and its

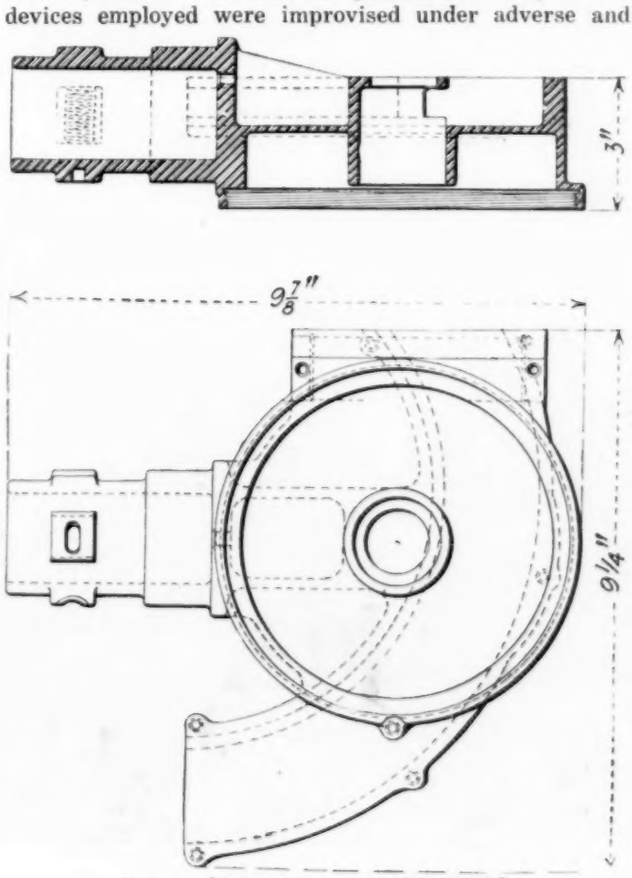


FIG. 8. BODY OF QUADRANT SIGHT

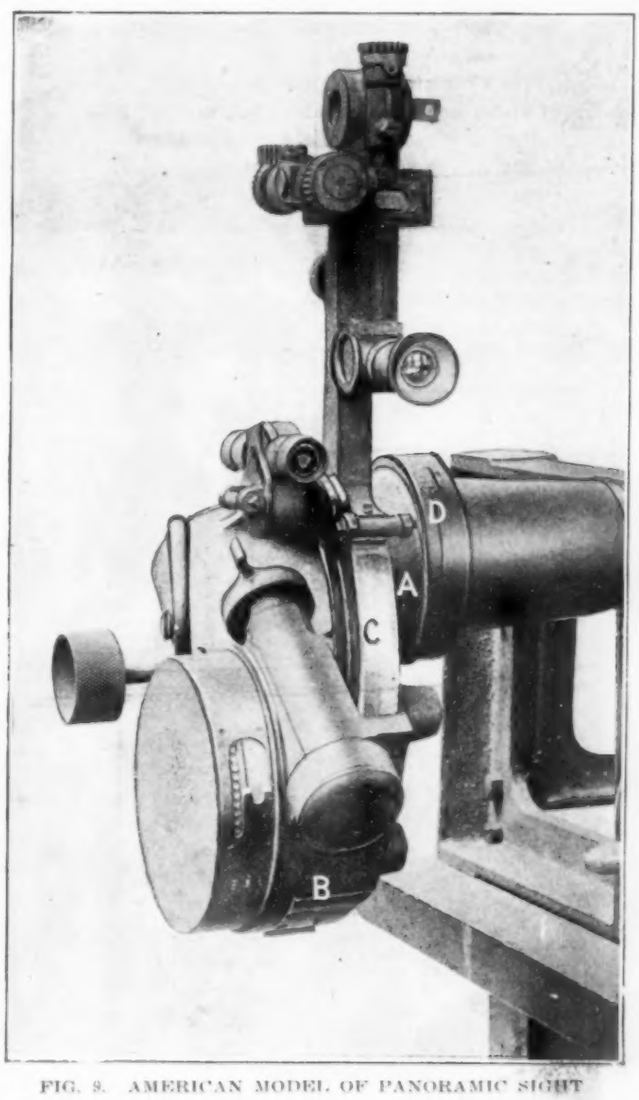


FIG. 9. AMERICAN MODEL OF PANORAMIC SIGHT

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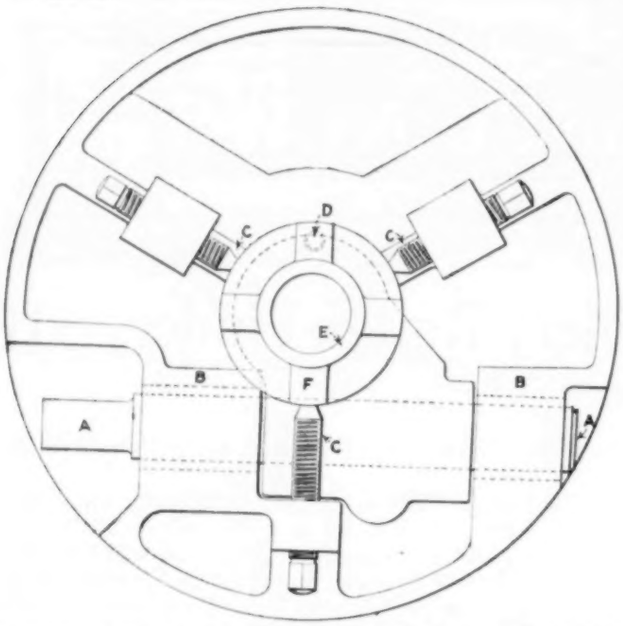
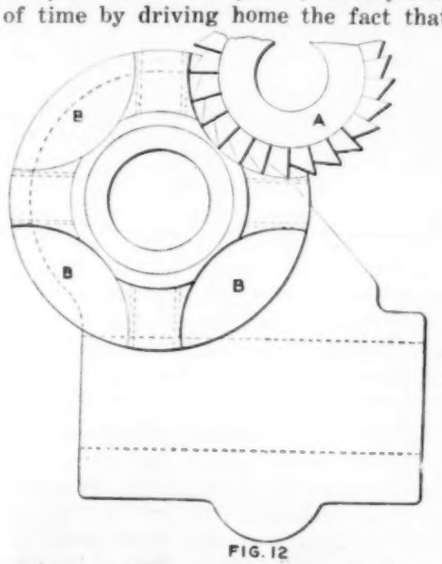


FIG. 10. SCHEMATIC DRAWINGS OF THE HOODED LATHE CHUCK USED IN MACHINING GUN-SIGHT BRACKET

contours are multiplied in endless variety; ideal work for profiling machines, but the French practice in manufacture has not reached the stage that departs from the chalked-surface layout method, scribed diagrammatic lines and skilled operators to follow them. The possibilities of jigs and fixtures are not developed in any direction. Their product is the result of skill in many instances—skill at the expense of time and the use of special devices.

Time being the essence of all things, American preparation for the quantity production of this apparatus did two things that spelled dispatch: First, they engaged an expert to analyze European methods of manufacture, labor conditions and costs, to formulate a tool program of magnitude and efficiency. Second, a body of trained engineers was gathered together to study the operations in production and conduct a schooling system for the draftsmen in performing their calculations directly in the metric system, thereby saving a great deal of time by driving home the fact that the conversion



FIGS. 12 AND 13. SHOWING THE METHOD OF ROUGH-MILLING TENONS ON BRACKET MEMBER AND THE FORMING TOOL FOR FINISHING THE TENONS

of final results into inches was a safer and shorter cut than to convert every fraction. This schooling system was not limited to draftsmen alone but was extended to many others in touch with ordnance material and the functions of range-finding apparatus.

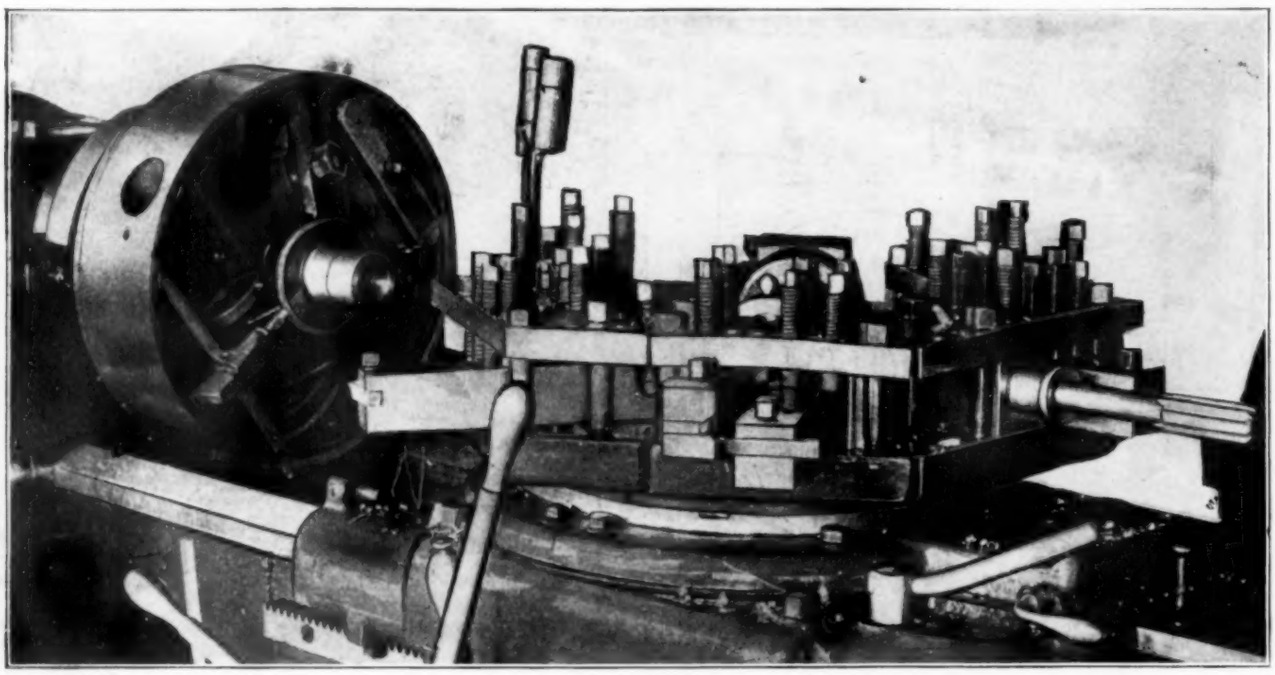


FIG. 11. A HOODED LATHE CHUCK IN USE

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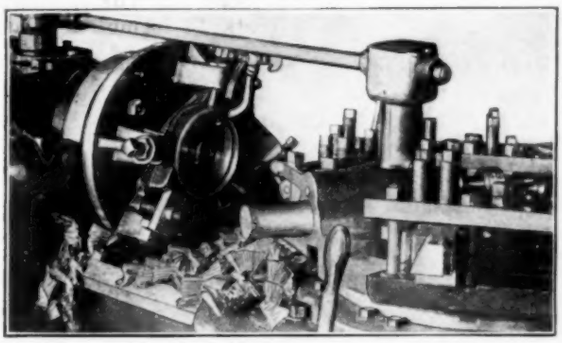

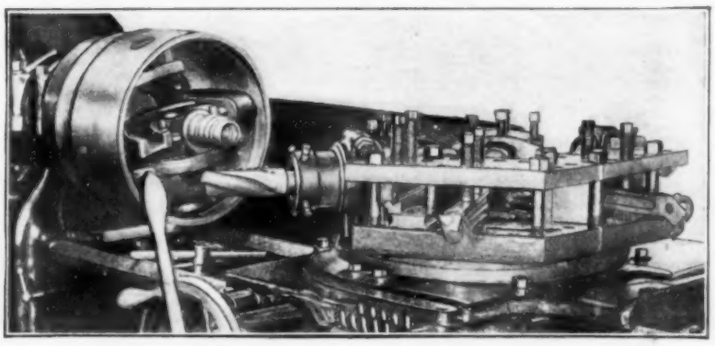

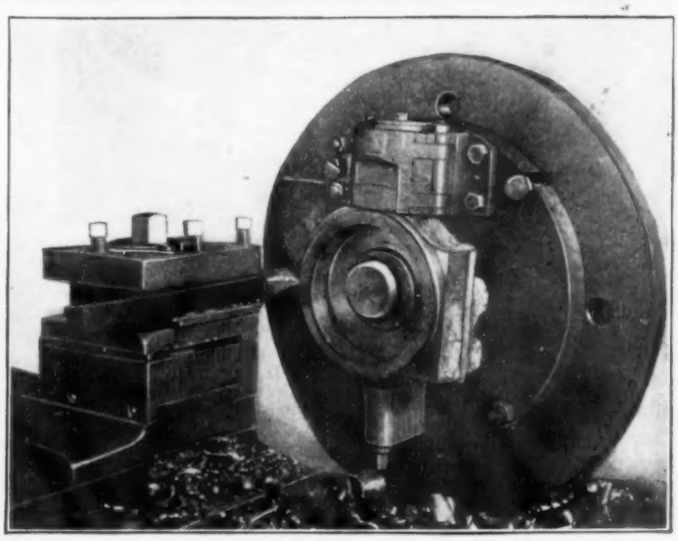

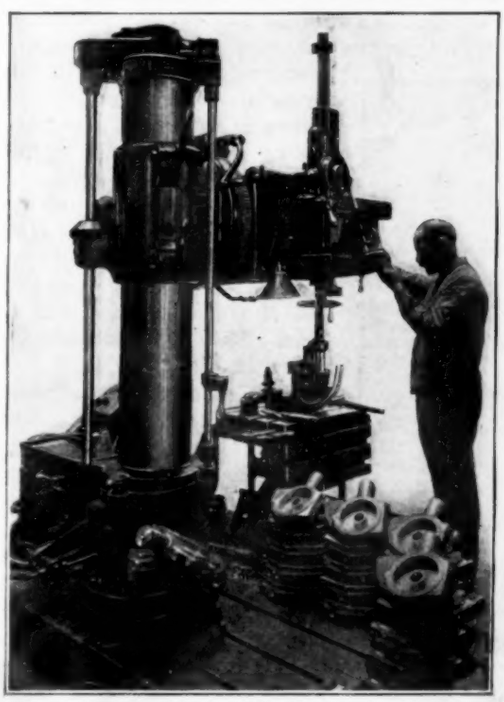

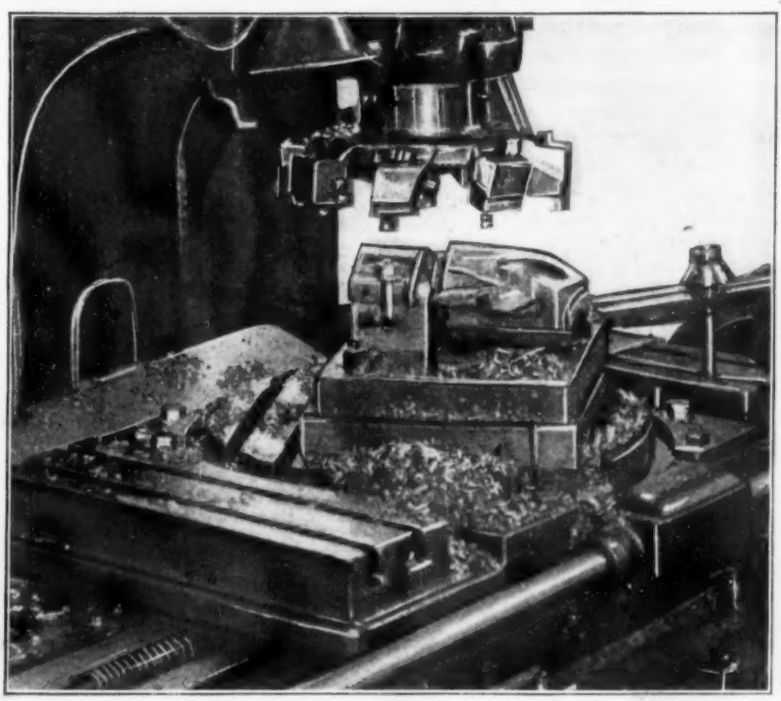

FIGS. 15 TO 20. VARIOUS MACHINING OPERATIONS

Figs. 15 and 16—Typical American methods of machining the body member. Fig. 17—The French method of turning between centers the shank of the body member. Fig. 18—The French method of turning the box side of the body member. Fig. 19—Boring the wormshaft hole of the body member as employed by both French and American manufacturers. Fig. 20—Typical French method of milling the channel section of the body member.

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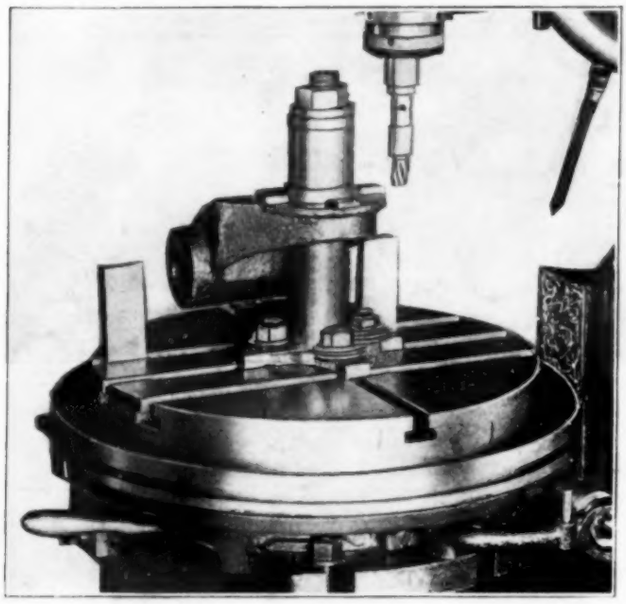

FIG. 11. THE FRENCH METHOD FOR FINISHING THE TENONS ON THE BRACKET MEMBER

An idea of the manifold details of the quadrant gun sight is shown in Fig. 9 and it is obvious that the tools, jigs and fixtures used in its manufacture are somewhat complicated. The three principal parts are the bracket *A*, the body *B*, and the sector *C*. Four tenons *D* appear on the flange of the bracket *A*, and are the means of adaptation to the gun cradle. The tenons are machined first and are used as locating points for all subsequent operations.

A feature worthy of note is the protection afforded the operators by the hooded construction of the lathe chucks, Fig. 10, a feature which is lacking in the tools employed by the French. The bracket forging is mounted on the mandrel *A* which is supported by the bosses *B*, the bosses being a part of the chuck casting. The forging is then lined up and held in place by the screws *C*. The thrust of the tool is taken up by the stop screw *D*. By chucking the part in this manner the shank *E* and tenons *F* of the bracket are machined first. Fig. 11 shows this chuck in use. The unique

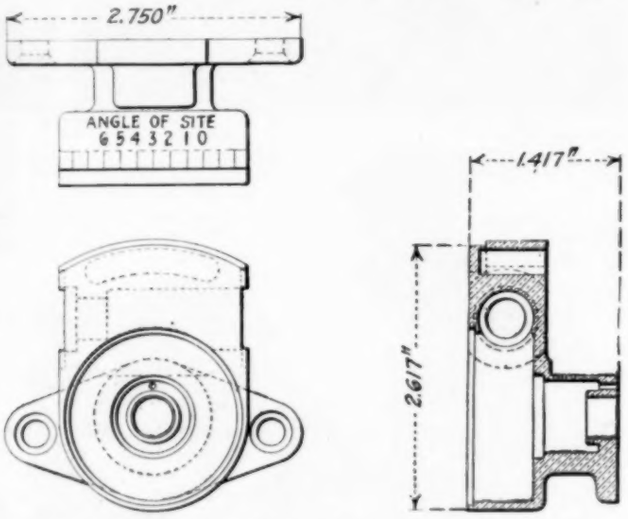

FIG. 22. DETAILS OF THE ANGLE OF SITE WORM HOUSING

turret toolholder makes it possible to set up several tools in different positions for multi-operations.

The machining of the tenons on the flange *D*, Fig. 9, employs a four-position milling fixture. The work is arranged vertically in the fixture and the operation imposes only two steps in the formation of the tenons. The fixture is set up in a vertical milling machine and in the first step a milling cutter *A* roughs the flange *B* as shown in Fig. 12. The part is then set up in a similar index fixture in a shaping machine and the tenons machined to gage. The tool employed is shown in Fig. 13.

The French employ a rotating table and plane radially between the tenons, after which the latter are milled to gage on a vertical milling machine as shown in Fig. 14.

The French adhered to the layout method of scribing on whitened surfaces and depending on skilled operators to follow the lines in preference to or for lack of profiling facilities. There were, however, profiling machines on the premises, American machinery being much in evidence.

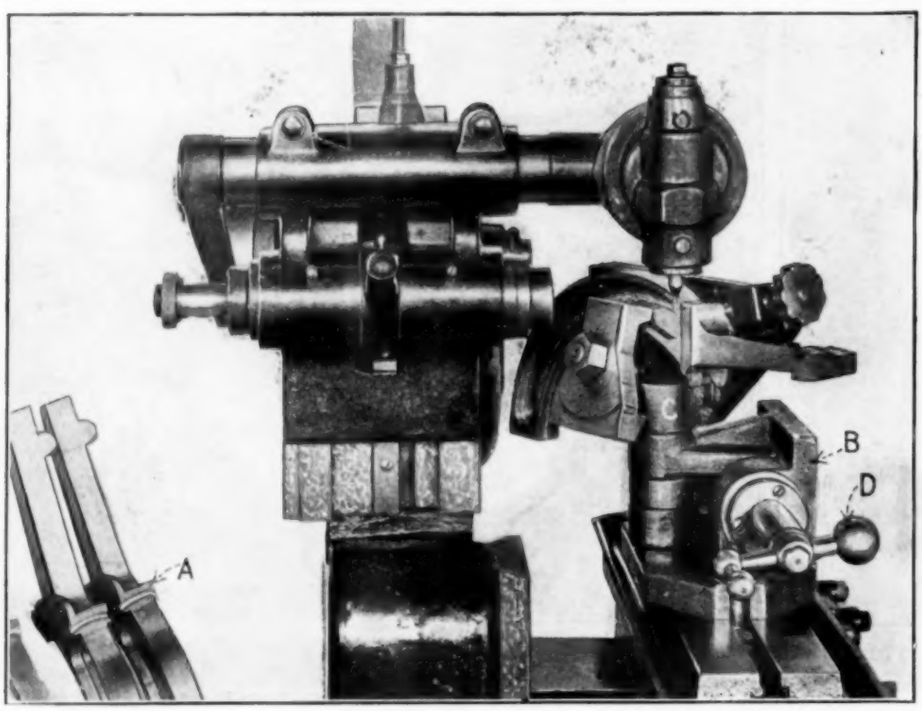

FIG. 21. MILLING A SMALL T-SLOT IN THE SECTOR MEMBER

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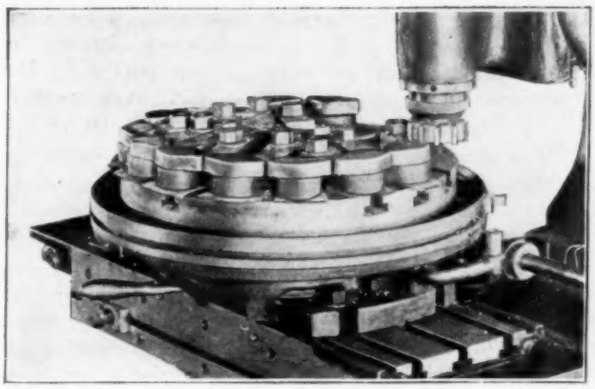
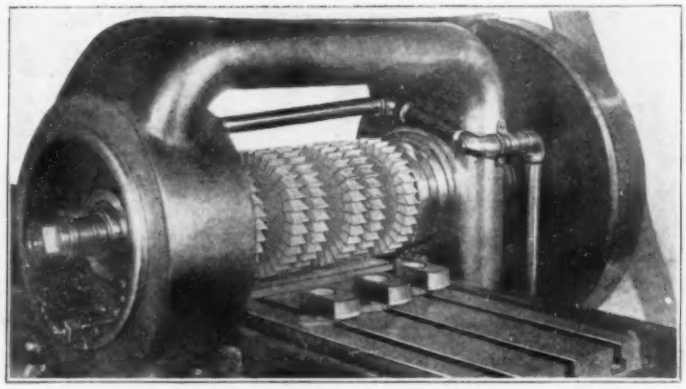




FIGS. 23 AND 24. MULTIPLE MILLING OPERATIONS ON THE ANGLE OF SITE WORM HOUSING

That the French did not make use of the jigs and fixtures is shown in the following comparison of the French and American sequences of operations employed in machining the body of the quadrant sight, Fig. 8.

FRENCH METHOD

1. Whiten with chalk.
2. Layout contours.
3. Drill lathe center holes in shank.
4. Turn shank between centers; engine lathe.
5. Bore the open side of box; engine lathe.
6. Drill the wormshaft hole tangent to the box recess; radial drilling machine.
7. Layout contours on channel side.
8. Mill the indent surfaces and rough-mill to the diagram for the contours; vertical milling machine.
9. Rough-mill the channel; heavy-duty vertical milling machine.
10. Finish-turn the channel; engine lathe.
11. Bore shank; drilling machine.
12. Finish-turn shank; engine lathe.
13. Finish-end-mill the contours in vertical milling machine.

AMERICAN METHOD

1. Turn, bore, face and thread the box side complete; turret lathe.
2. Turn, bore, and face the shank complete; turret lathe.
3. Face the channel side and rough the channel shape; turret lathe.
4. Drill the wormshaft hole tangent to the large box recess; radial drilling machine.
5. Profile horizontal steps and contours on the box side; profiling machine.
6. Profile the indents and the contours on the channel side; profiling machine.
7. Finish-turn channel, engine lathe.

Aside from the foregoing are minor operations which are more dependent on shop expedients than on sequence; however, the brevity of the American method as compared with the French is due purely to a careful analysis of sequence and tools.

Some of the more noticeable differences in methods are brought out in Figs. 16 and 17, and Figs. 15 and 18. Note the design of the lathe tool in Fig. 18, which permits the work to turn away from the operator.

The French method of performing Op. 6, shown in Fig. 19, was adapted in this country to an American-built machine.

The French practice shown in Fig. 20 is excellent. The multiple tool is designed to swing the complete circle of the channel shape, and the time required to mill the groove, ready for finishing on an engine lathe, is but a few minutes including setting and clamping. The machine used is a heavy-duty vertical milling machine of French design and manufacture.

The milling of the small intricate curved T-slot *A*, Fig. 21, is interesting. The radius of this detail is 1.850 in. to the center of the groove. The fixture consists of a brace bracket *B* which is attached to the table of the machine and has a vertical shaft *C* whose axis is the center of the radius about which the work swivels. The work is swiveled by means of the handle *D* which actuates a wormshaft engaged with the vertical shaft *C*. Two tools are employed, one a straight end-mill fed to the required depth followed by the second T-cutter for the under cut.

Typical multiple milling operations of the angle of site, Fig. 22, are shown in Figs. 23 and 24.

In the partial assembly shown in Fig. 25, the angle of site is mounted on the sector which is extended from the channel in the body. The shank of the body member is within the bracket and the box side of the body is exposed to reveal the actuating worm of the dis-

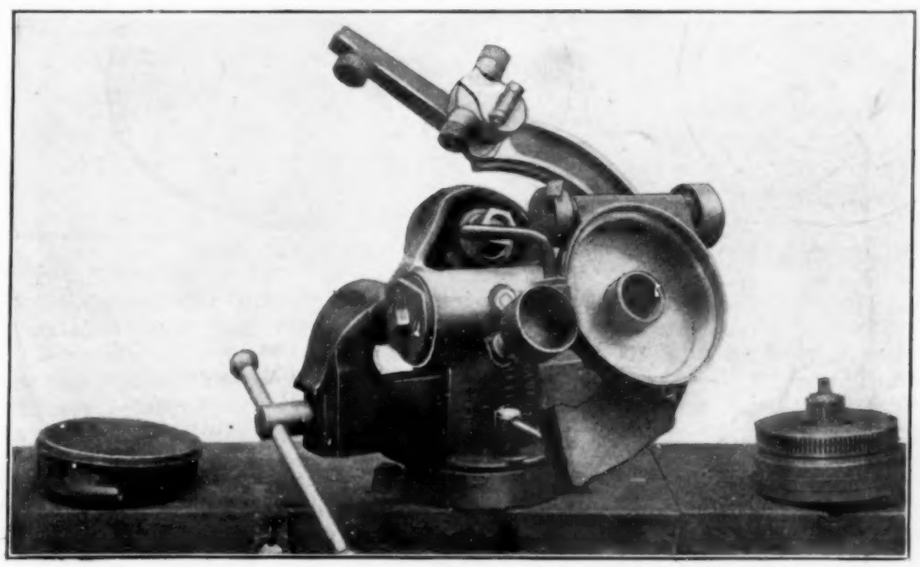


FIG. 25. ASSEMBLING THE QUADRANT SIGHT

mantled drum. The pinion of the drum engages the back teeth of the sector shown through the exposed bore. This worm acts as a lock and a means of precise adjustment of the scale drum and is mounted in eccentric bearings which can be thrown out of mesh, thereby permitting a rapid approximate setting of the drum scale.

Fixture for Milling Clutch Rings

By M. J. Schmitt

The illustrations show a special holding and indexing fixture which was made by Kearney & Trecker Co., Milwaukee, Wis., for straddle-milling the three lugs of clutch rings, one of which the operator is holding

FIG. 1. FIXTURE FOR MILLING CLUTCH RINGS

in his hand in Fig. 1 The rings are of malleable iron, and must be milled with a tolerance of 0.001 in.

The fixture is provided with a hardened-steel plate *A*, Fig. 2, into which the clutch ring fits, and this is attached to a cast-iron body *B*, arranged to be revolved

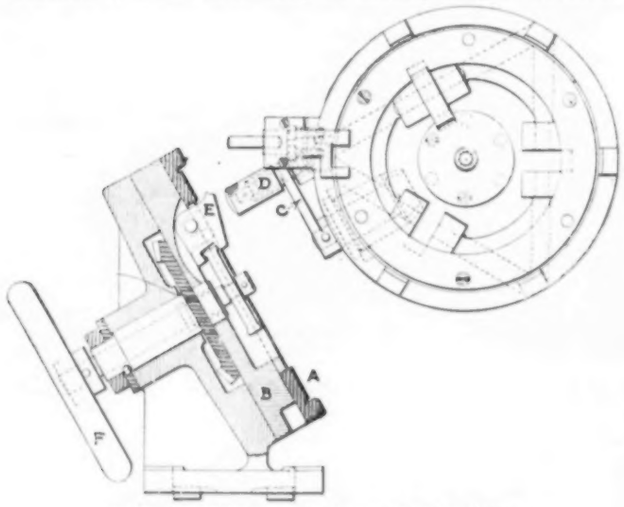


FIG. 2. DETAILS OF THE FIXTURE

by means of a bevel gear and pinion, operated by the indexing crank *C*. The ratio of the gears is such that one revolution of the pinion turns the plate one-third of a revolution, or equal to the distance between the centers of the lugs on the clutch ring. Attached to the handle end of the indexing lever is a plunger *D* which fits into a hole at the top of the fixture, and both handle and hole perform the same duties as the handle and holes on an index plate of an ordinary dividing head. Arranged around the inside edge of the steel plate *A* are three clamps *E* which are operated by the handwheel *F* at the rear of the fixture. One revolution of the handwheel is sufficient to clamp the ring firmly in place. To locate the rings properly with relation to the cutters, a gage is located at the top and front of the fixture. The opening in the gage is just large enough to fit over one of the lugs in the rough casting and when in place the lug at the bottom of the ring is in position to be milled. When the ring has been properly set by the gage, the clamps are drawn down by the handwheel, locking it into place. The gage can then be withdrawn, allowing the holding plate to revolve as desired, and is held away from the work by a ball and spring arrangement directly behind it.

When milling, the table of the machine is fed by hand, bringing the work into the cutters, and a positive table stop prevents it from going in too far. After reaching this stop, the table is returned by hand, and the fixture indexed into the second position, this operation being repeated until the three lugs have been machined. The work may be removed by releasing the clamps by the handwheel *F*, and a fresh casting placed on the fixture. With this fixture the floor to floor time on each piece was reduced to 33 sec., cutting the old milling time approximately in half.

A Metal Disk Identifies the Producer

By Peter F. O'Shea

In the tap-making department of the Greenfield Tap and Die Corp. a sheet-iron disk is tossed into a pailful of product to identify the man who did the work. The disk is galvanized iron, 3 x $\frac{1}{32}$ in., and has a $\frac{3}{4}$-in. hole punched in the center so that it may be hung on a nail. Each disk has the number of a workman stamped into one surface in figures $\frac{3}{8}$ in. high. When the pan or pail of product goes to the inspection bench,

ONE OF THE METAL DISKS

the galvanized-iron disk in it tells which man is to be credited with the output or held responsible for spoiled work.

Each man is furnished with a dozen disks, all bearing his own payroll number. When a machine operator is ready to send a batch of product for inspection, it is much simpler and quicker for him to toss one of his disks into the pail than to stop and write his name on a paper card, which might become soiled or illegible.

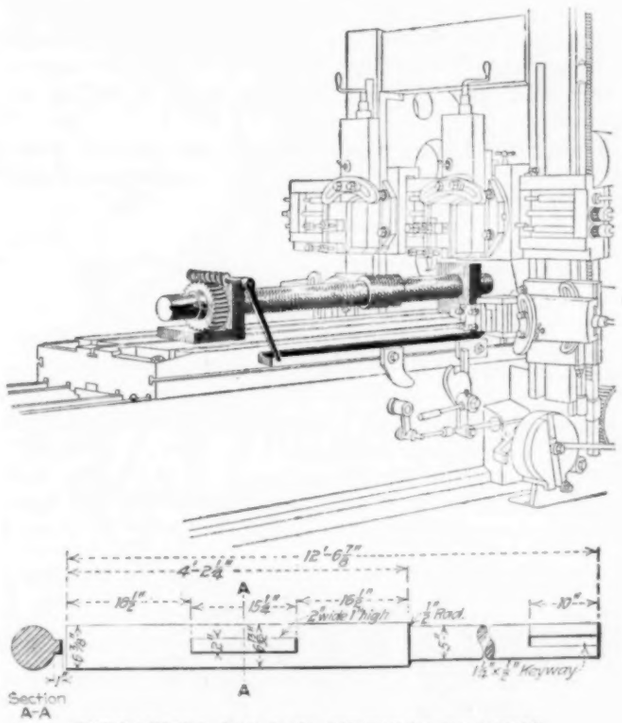
As fast as the product is inspected, the inspector hangs the disks on nails along his bench, and later distributes them to the men for use again.

A Homemade Circular Planing Rig

By F. F. Wolfe

The illustration shows a rig which was devised for planing that part of a large driving shaft which had a raised key made integral with the shaft. The shaft was 6 13/32 in. in diameter at the place where the key was, while the key itself was 2 in. wide, 1 in. high and 15½ in. long.

Two brackets that had previously been used for a boring job on a Corliss engine happened to be on hand.



IMPROVISED RIG FOR CIRCULAR PLANING

These were fitted to the bed of a planing machine and the bore enlarged to make a close running fit on the shaft.

A wormwheel was fastened to the shaft by setscrews, its hub bearing against one of the brackets to take the thrust of the planing cut. Bearings for the worm-shaft were bolted to the bracket, and a rachet, with lever and pawl, placed on the outer end of the worm-shaft.

The planing machine was equipped with side heads and into one of these a bent bar was clamped in such a position that it would strike the pawl lever at the end of each stroke. By raising or lowering this head the feed of the work could be adjusted to suit the cutting conditions.

The rigging up of the device, including necessary alterations of parts used, and the planing of the shaft to a neat sliding fit in the hub of a large gear, occupied 12 hours.

Rejuvenating Obsolete Machine Tools

By E. A. Dixie

One is often at a loss to know what to do with machine tools which have become obsolete. In practically every shop there are lathes and other machine tools which because of their lightness have no place in the machine shop in these days of high-speed steels and intensive production.

The illustration shows an old Springfield Tool Co. lathe built 63 years ago. Originally, it was about 18 in. swing and no doubt as judged by the production of its contemporaries it was a satisfactory tool. At the time when it was decided to discard it, its scrap value was about ¼c. a pound. Although far too light for metal turning, the boss patternmaker was in need of a pattern lathe that would swing fairly heavy wooden patterns 30 in. in diameter between centers and above

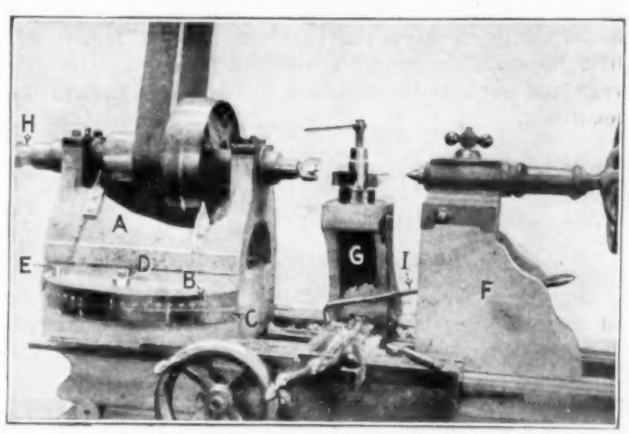


FIG. 1. THE OLD ENGINE LATHE NOW A PATTERN LATHE

this diameter on a faceplate at the rear of the headstock. So instead of scrapping the lathe it was turned over to the pattern department for alterations and installation.

The head *A* was mounted on a base *B* which in turn pivots on a sub-base *C* secured to the bed of the lathe. A central bolt passes through *B* and *C*. The sub-base *C* has a circular T-slot to accommodate the heads of the bolts *D* which clamp *B* and *C* together. It will be noted that a circular flange extends horizontally from *B* and

also from *C*. The flange of *B* is graduated up to 45 deg. on each side of the center. A center line on *C* assists in setting *B*. To assure that the head can be always set back to turn parallel a taper pin is fitted through *B* and *C* at *E*. It will be noted that this taper pin is chained to the lathe head so that there is no danger of losing it.

The tail center has been raised on the base *F* and the toolpost raised by the casting *G*. The original spindle of the headstock was replaced by the one shown. This has a right-hand thread on the front end and a left-hand thread on the rear end. While it is not in use the left-hand thread is protected by the small flanged collar shown at *H*. This flanged collar serves a double purpose, as a protector for the thread and also as a pulley for driving a band-saw sharpening machine located nearby.

The swiveling head is very handy for pattern work. Take for instance a job that recently went through the shop. This was a cone approximately 22 in. in diameter, 12 in. deep and had walls $\frac{3}{16}$ in. in diameter. For certain reasons it was advisable to have a separate core and not make the pattern so that it would leave its own core. The headstock was swiveled five degrees, the taper of the cone, and the outside of the pattern turned; with the same setting the corebox was bored, insuring practically exact parallelism of the inside and outside of the finished casting.

The graduated-head feature often works in well in connection with the other tools in the pattern shop, for instance: Where tapered segmental cores are used in producing a casting the pattern can be turned on the lathe, setting the swivel at say 10 deg. Owing to lack of balance it is seldom advisable to turn segments of circles or segmental coreboxes so these are usually cut out on the bandsaw. Ten degrees on the bandsaw give the same results as 10 deg. on the lathe so the two can be made to work together very nicely. At *I* is shown a little afterthought of the patternmaker. We all know about moving the tailstock away from the headstock by racking the carriage against it but the little hook shown connects the tailstock with the carriage and permits the tailstock to be racked toward the headstock.

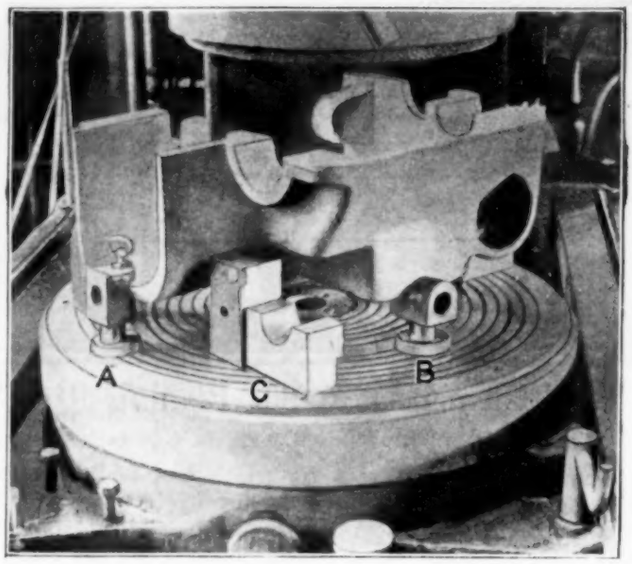
Holding Irregular Pieces on the Magnetic Chuck

SPECIAL CORRESPONDENCE

The use of the magnetic chuck has increased beyond all expectations, but for the most part has been confined to the holding of objects which presented flat surfaces to the magnetic face of the chuck. The illustration shows a novel method of utilizing the magnetic chuck on work for which it has heretofore been considered necessary to provide special holding fixtures.

The work shown is half of a gear box and, instead of having a special holding fixture, it is supported on three special jacks, two of which are shown at *A* and *B*. The jack *A* is made with an opening on the side which fits over the edge of the casting and has a thumbscrew by which it can be clamped to it. The other jack is provided with a lip on which the casting rests, and the third jack is of a similar nature.

All of the jacks have a flat round base, 3 in. in diameter, and are held magnetically to the chuck, as well as conducting the magnetism to the work itself.



HOLDING IRREGULAR WORK MAGNETICALLY

These both support and hold the casting, and, as an aid in driving it against the cut of the grinding wheel, the steel blocks *C* are also placed on the chuck. Presenting a considerable magnetic surface, they serve as substantial stops to prevent the turning of the work on the chuck. The size of the work can be readily determined from the fact that the table is 26½ in. in diameter.

This method of holding work is the present practice of the Blanchard Machine Co., Cambridge, Mass., with its grinding machines.

A Gang Punch for Lead Plates

BY FRANK A. STANLEY

The illustration, Fig. 1, shows a press outfit made for piercing lead plates for use in connection with battery work. The lead plates are about $\frac{3}{16}$ in. thick and approximately 16 x 20 in. in area. The punches number 368 all told and are arranged in 39 rows of 12 each.

The purpose of these punches is to pierce the lead sheet but not to cut out the metal completely and leave a clean sharp corner; but, rather, to throw up a burr

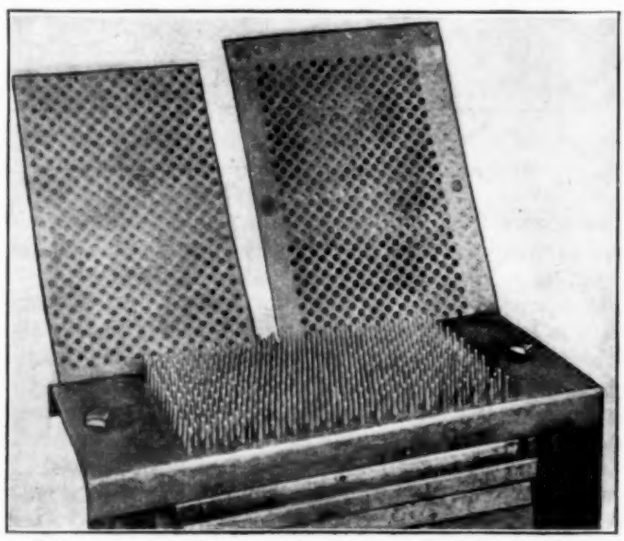


FIG. 1. THE GANG PUNCH AND THE WORK

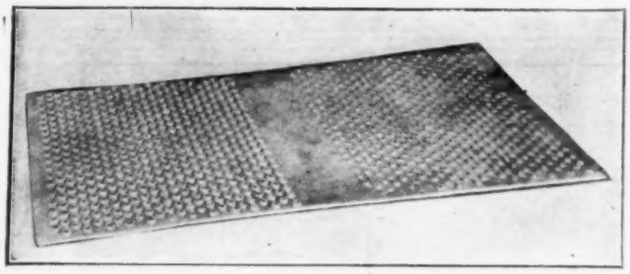
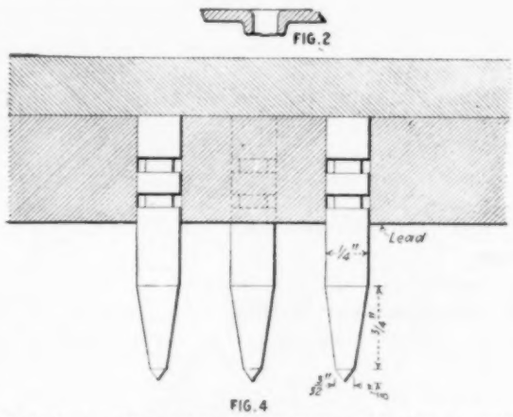


FIG. 3. HOW THE METAL IS THROWN UP ON THE UNDER SIDE OF THE PLATE

or fin on the under side of the plate just as a tapered center punch would leave a piece of sheet metal if driven through, the action being to indent the metal and then upon breaking through to form a shallow wall around the hole as in Fig. 2. This leaves the maximum area of metal upon the surface of the plate. The effect is illustrated by Fig. 3, which shows the under side of the plate as it comes from the press.



FIGS. 2 AND 4. FORM OF HOLE PIERCED AND A SECTION SHOWING METHOD OF HOLDING PUNCHES

A section showing the method of carrying the individual punches is represented in Fig. 4. These punches are made of drill rod $\frac{1}{4}$ in. in diameter and the lower ends are tapered for a distance of $\frac{3}{4}$ in. from the body size down to $\frac{3}{32}$ in. They are then brought to sharp points which resemble closely the proportions of a regular center punch.

In making up the punch holder for this job the punches were set upright in a locating plate and lead was then poured into the surrounding form to inclose all of the punches and hold them securely by means of the anchor grooves, two of which are shown as cut around the body of each punch. The punches project from the face of the lead holder about $1\frac{1}{2}$ inches.

This gang punch was originally tried out under a heavy drop and curiously enough, at least upon first thought, the punches could not be forced through the lead plate sufficiently to give the desired size of hole. The effect under this method is indicated by the small holes shown at the right-hand side of the double sheet, Fig. 5. When the work was transferred to a heavy punching machine there was no difficulty in forcing the punches through the desired amount and producing holes of the required diameter as shown in the left-hand side of the sheet.

When we consider the total area acted upon by the 368 punches and also allow for the wedging action of the tapered ends, which would cause the metal to be compressed in all directions before the points of the punches could break through, it would appear that the very rapid blow applied under the drop did not permit of sufficient time for the metal to flow and as a consequence the force of the blow was absorbed and the punch brought to rest before the desired work had been accomplished. Under the relatively slow action of the punching machine, however, the flow of the metal took place naturally and the punches were forced through to the desired point without difficulty.

This press work was handled at the shop of the Gilro Machine Co., Oakland, California.

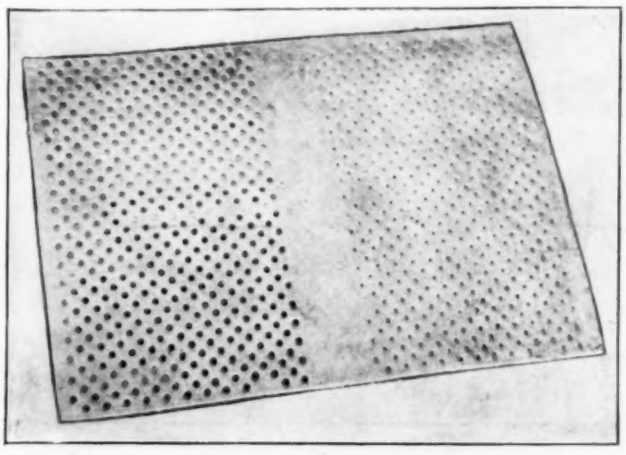
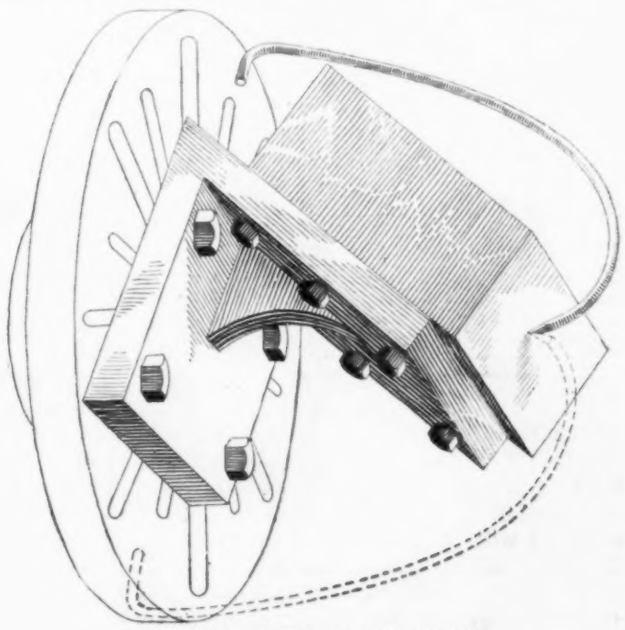


FIG. 5. SHOWING EFFECT PRODUCED BY DIFFERENT METHODS OF PUNCHING

Locating a Job on the Lathe Faceplate

BY GUSTAVE A. REMACLE

It sometimes happens that work to be bored on a lathe is of such shape that it is desirable to remove the faceplate from the lathe in order to clamp the job in place. In such cases the work may be located to nearly its proper position by bending a piece of rod as shown in the sketch and swinging it around to different points. I get the best results by bending the rod so that the end rests upon the face of the plate near its periphery.



LOCATING WORK ON FACEPLATE

A *Complete* Condensed Clipping Index of Equipment

IN our issue of July 26, 1917, we printed the first page of our Condensed Clipping Index of Equipment. This and subsequent pages attracted widespread favorable comment.

The cuts and data put on the index cards are condensed from the more complete descriptions previously appearing in our Shop Equipment News section.

Purchasing agents, factory managers, superintendents and others who wish to have descriptions of the latest mechanical productions readily available for quick reference, keep these cards on file and up to date.

Only equipment that has not been on the open market over six months is eligible for space in our Shop Equipment News section and, consequently, in the Clipping Index. For this reason, no complete card index can be made of the entire line of any one manufacturer, unless such equipment is described as it is first put on the market. This naturally excludes all equipment put on the market more than a few weeks previous to our first index page.

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Ethan Viall

Editor

SHOP EQUIPMENT NEWS

-Edited By-
E. L. DUNN and S. A. HAND

SHOP EQUIPMENT NEWS
A weekly review of modern designs and equipment

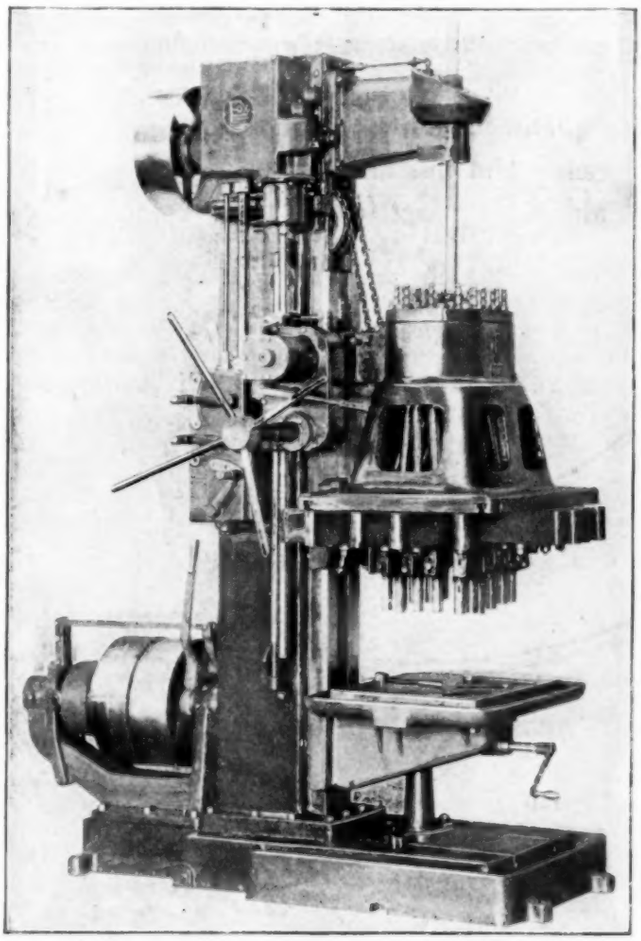
Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

CONDENSED CLIPPING INDEX
A continuous record of modern designs and equipment

Fox Multiple-Spindle Drilling Machine

The Fox Machine Co., 1804 West Ganson St., Jackson, Mich., has added to its line a multiple-spindle drilling machine known as its No. D-22, as illustrated.

The base is provided with T-slots, has a broad and deep oil channel and provision for straining the oil or cutting compound before entering the reservoir. The column is of box section and accommodates the gear box at the top, the counterbalance weight on the inside and the oil pump and tank on the right side. The drive is of the constant-speed type and power is delivered to the head of the machine through a disk clutch and belt. The gear box contains all shafts and gears necessary for the three changes of fast and slow spindle-speeds. For the feed, power is taken from a variable-speed shaft through two sets of cone gears and through a worm and gear on the vertical feed shaft. All gears are inclosed and lubricated, and the thrust of all shafts is taken by ball bearings. The oil pump distributes oil to the gears on top of the machine.



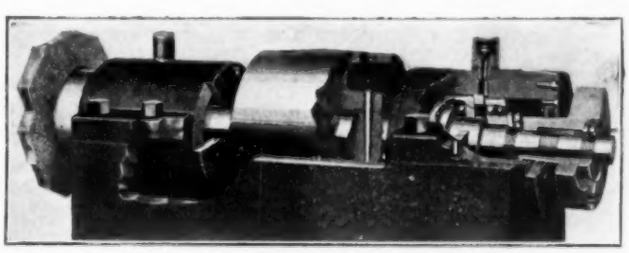
FOX MULTIPLE-SPINDLE DRILLING MACHINE

Specifications: Head travel, 24 in.; drilling area, 12 x 18 in. rectangular, or 16 in. round; center of head to face of column, 14 in.; work surface of table, 18 x 24 in.; table to base, maximum 29 in., minimum 10 in.; height to top of frame, 99 in.; height to top of drive shaft, 120 in.; maximum number of spindles, 1 speed 24, 2 speeds 16; pulley, 16 x 5¼ in.; speed, 450 r.p.m.; hp., 5; floor space, 46 x 75 in.; weight, net 5,000 lb., crated 5,500 lb.; will drill eight ¾-in. or twenty-four ½-in. holes at speed of 70 ft. per minute and feed of 0.0045 in. per revolution in cast iron.

The saddle has a long bearing on the column, is separate from the head to which it is bolted and is gibbed to the column. The spindle-bearing adjusting-arm is claimed to be firm, to hold the spindles perpendicular with the least possible deflection under heavy duty and to be easily adjusted. The universal joints are driven by keys and are easily removable. The machine can be driven either by motor or belt.

Improved Spindle Construction for Badger Grinding Machines

The Badger Tool Co., Beloit, Wis., has adapted a ball-bearing spindle mounting, illustrated herewith, for its grinding machines. This type of construction uses one radial bearing in each housing, together with an additional double row of ball-thrust bearings in the left-hand housing. To aid in obtaining a more perfect mounting the bearings are fitted into individual housings which are detachable from the main body of the machine. Consequently, these are relatively small castings and it is possible to maintain a better grade of workmanship when fitting in the bearings.



BADGER BALL-BEARING-SPINDLE CONSTRUCTION

The ends of the Badger spindles are turned and ground to an accurate taper and the wheel collars are drawn up on the taper by means of a locking nut. Solid renewable felt rings are placed in all end caps and are held by the removable end plates shown. A special grease filler cap is provided to prevent dirt and grit from entering the bearings.

Champion All-In-One Furnace

The portable furnace illustrated is built as a unit by the Champion Kerosene Burner Co., Kenton, Ohio. It was designed to meet the requirements of the structural steel fabricator and is suitable for outside work as well as inside. It is further recommended by the makers for heat-treating and general forge work. Being entirely self-contained it can be moved about at will even when in operation. The heat is generated by a

CHAMPION TYPE "A" ALL-IN-ONE FURNACE

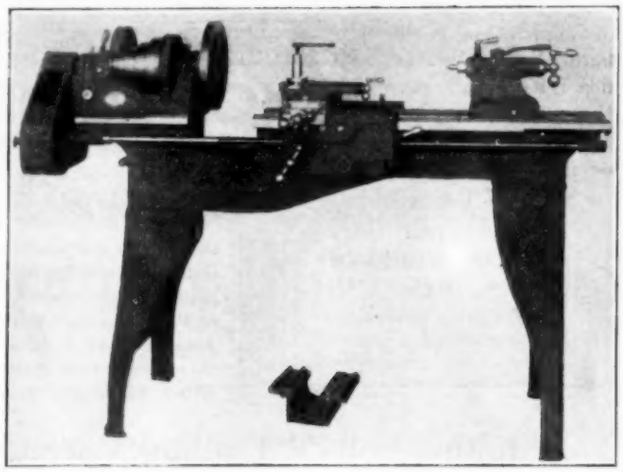
kerosene burner that is said to produce a temperature of 2,500 to 3,000 deg. F. in five minutes' time. The nature of the flame is such that there is a minimum of oxidization smoke and odor. Several types are made to suit various conditions under which they are to be used. For close quarters inside, a small model with a cylindrical firebox is furnished.

Star Gap Lathes

The Seneca Falls Manufacturing Co., Inc., Seneca Falls, N. Y., has brought out two sizes of gap lathes—one with an 11 and 18 in. swing and the other with a 13 and 21 in. swing. The former is shown in the illustration.

The beds are of the box-section type, thoroughly braced by cross-webs and made very heavy through the gap sections to insure stiffness. Bridge pieces are furnished to close up the gaps when the extra swing of the gaps is not needed. Beds are made 5, 6, 7, 8 and 10 ft. long.

The crossfeed screws are supplied with micrometer collars graduated in thousandths of an inch. The



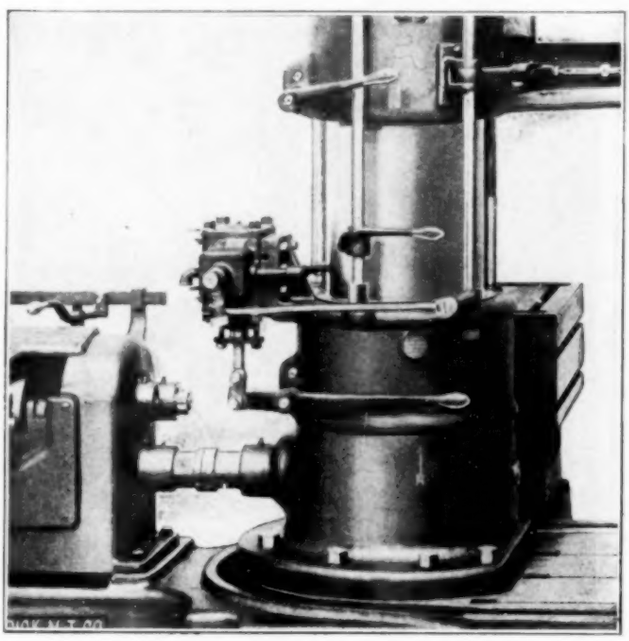
11 AND 18 IN. SWING STAR GAP LATHE

aprons have safety devices, so that longitudinal feeds and split nuts cannot be engaged at the same time. All standard threads, from 3 to 72, can be cut, including 11½ and 27 pipe threads. The lathes can be equipped with transposing gears or metric pitch lead screws for cutting metric threads.

The extra attachments that can be furnished include raising blocks, quick-change gears, taper attachment, motor drive, draw-in chuck, milling and gear-cutting attachment, etc. Weights: 11 and 18 in. swing gap lathe with 6-ft. bed, 880 lb.; 13 and 21 in., with 6-ft. bed, 1,390 pounds.

Fosdick Arm-Clamping Device for Radial Drilling Machines

The Fosdick Machine Tool Co., Cincinnati, Ohio, is equipping its radial drilling machines with a combination clamping device that operates either by compressed air or by hand. It is attached near the base of the column and as may be seen from the illustration has



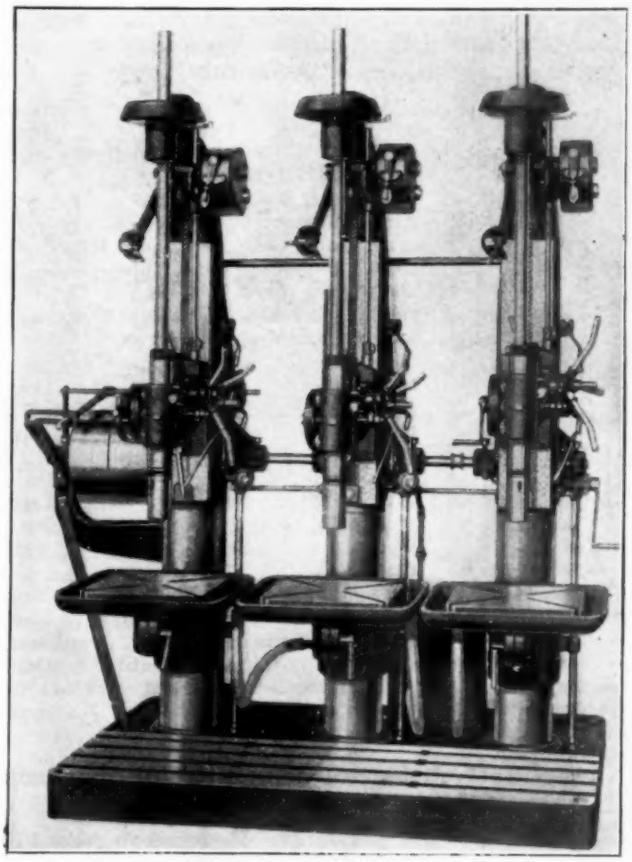
FOSDICK ARM-CLAMPING DEVICE FOR RADIAL DRILLING MACHINES

no connection with the spindle head. The appliance being located directly at the point of clamping simplifies the arrangement. It is intended for low pressure, the relief valves being set for 45 lb., though it is said to operate without shock or jar at pressures of 150 lb. or more owing to the air cushion that is provided at each end of the cylinder. The valve is of the flat disk type and has six ports which gradually admit or discharge the air. The valve is controlled mechanically by a horizontal shifting rod that extends the full length of the radial arm and is accordingly within easy reach of the operator at all times. If the supply of compressed air should fail the clamp may be operated by hand in the usual manner.

Barnes All-Geared 26-In. Gang-Drilling Machine With Sliding Heads

The Barnes Drill Co., 814-830 Chestnut St., Rockford, Ill., has placed on the market a 26-in. all-geared gang-drilling machine with sliding heads as shown in the illustration.

The heads are counterweighted and are gibbed to the column faces. They can be raised or lowered by means of the usual racks and pinions and may be held at any point by quick-acting clamps. Adjustable stops are provided so that the heads can be repeatedly located at the same place. This machine can be furnished with either round or square tables and automatic reversing mechanisms for use in tapping.



BARNES ALL-GEARED 26-IN. GANG-DRILLING MACHINE WITH SLIDING HEADS

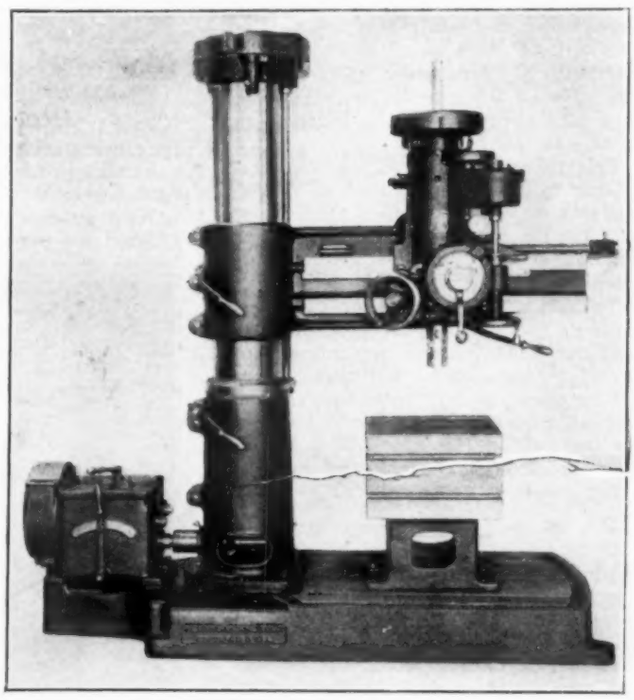
Specifications: Capacity, 2 in. hole; distance, center to center of spindles, 24 in.; face of column to center of table, 12 in.; diameter of spindles, 1½ in.; hole in spindle, No. 4 Morse taper; distance, spindle to table, maximum, 40 in.; spindle to base, maximum 53⅛ in., minimum 18⅛ in.; vertical travel; spindle, 14 in.; head, 23 in.; table, 20 in.; square table, 18 x 18 in.; round table, 23 in. in diameter; speeds, eight, 23 to 230 r.p.m.; feeds, eight, 0.005 to 0.075 in per rev.; all speeds and feeds independent of each other; floor space, 49 x 70 in.; speed of tight and loose pulleys, 325 r.p.m.; weight, net, 6,330 lb.; crated, 6,670 lb.

Morris Radial Drilling Machine

The Morris Machine Tool Co., Court and Harriet Sts., Cincinnati, Ohio, has brought out a re-designed radial drill which is illustrated herewith.

The changes embody the following: Inclosed type of head, back bracket and tapping attachment gears fully inclosed, dial depth gage on head, changes in head traversing device, gears in column cap do not revolve except when arm is being raised or lowered, base is deeper and heavier with oil channel completely around it ways on arm widened and some changes in gear bracket on back.

This machine can be furnished with either a 2½-, 3- or 3½-ft. arm.



MORRIS RADIAL DRILLING MACHINE

Specifications: Distance spindle to base (maximum, 52⅝ in.; minimum, 16½ in.); maximum distance spindle to table, 31⅜ in.; spindle traverse, 12 in.; taper hole in spindle, Morse No. 4; spindle speeds (cone drive, 20 to 400; speed-box drive, 18 to 400); work surface of table, 18 x 18 in.; work surface of base (with 2½-ft. arm, 30 x 35 in.; with 3-ft. arm, 30 x 41 in.; with 3½-ft. arm, 30 x 47 in.); weight, crated (with 2½-ft. arm, 4,000 lb.; with 3-ft. arm, 4,425 lb.; with 3½-ft. arm, 5,165 lb.)

"Velco" Push Keyway Cutters Erratum

In the article entitled "Velco Push Keyway Cutters," on page 800, Vol. 51, the address of the maker, the V. E. La Pointe Manufacturing Co., was incorrectly given. It should have been Manchester, Conn., and we request all our readers who intend keeping their copies for reference to make this change.

Sparks from the World's

By E. C. Porter,

Y. M. C. A. Schools File Applications for Machine Tools

Distribution of machine tools to Young Men's Christian Association schools, which have made application to the Director of Sales of the War Department for equipment under the Caldwell Act, will be conducted by the international supervisor of technical education of the association, according to a plan approved by the Director of Sales, Jan. 16.

Thirty-five Y. M. C. A. schools, comprising in the neighborhood of 44,000 students, have already filed application with the machine-tool section and other bureaus of the War Department for machine tools.

The office of the Director of Sales, through the machine-tool section, has sent out 1,000 purchasing coupons to various educational institutions, entitling them to call upon the various district offices of the several bureaus for the machine tools desired. A coupon is issued for each machine tool asked for by a school.

War Department Issues Bulletin Listing 4,000 Different Machine Tools

A revised and corrected list of surplus machine tools held by the various bureaus of the War Department, containing about 4,000 different machine tools valued at approximately $10,000,000, has just been issued by the Director of Sales.

This bulletin contains a complete description of every item listed, giving the make, size, capacity, condition, location and other important information of each tool. Only in the case of new tools, that is, where the condition is 100 per cent, is the selling price given. The bulletin as a whole contains the most comprehensive list of machine tools yet issued by the War Department.

While the descriptions contained in the bulletin are based on the best information obtainable, the Government does not guarantee the accuracy of such descriptions or warrant the condition and fitness of the machine tools or their suitability for the use intended to be made of them.

As a special feature, the bulletin contains instructions to educational institutions contemplating the acquisition of surplus machine tools under the Caldwell Act.

In view of the limited number of machine tools suitable for the use of educational institutions, schools desiring to acquire equipment under the act are urged to consummate their purchase within the time limit provided by the rules governing the distribution of machine tools to educational institutions.

Westinghouse Air Brake Company Organizes Export Department

In order to provide better facilities for handling its export business and for the development of its foreign trade the Westinghouse Air Brake Co. has organized an export department with

E. A. CRAIG

headquarters in the Westinghouse Building, Pittsburgh, Pa.

The new department began operation on Jan. 11, 1920, and is in charge of E. A. Craig, export manager.

Mr. Craig has been associated with the Westinghouse Air Brake Co. for thirty-two years. In 1905 he was appointed auditor and assistant secretary and in 1906 he was made Southwestern manager of the company.

This new export department will be represented in the New York office by W. G. Kaylor and in South America by R. M. Oates.

Machinery Club of Chicago Increases Space

The Machinery Club of Chicago has been able to acquire more space on the same floor of the building which they now occupy and this is being rapidly fitted up for the purposes of the club. The change will give the Machinery Club approximately 3,200 sq.ft. of additional floor space which will be used largely for recreation purposes.

Meeting of Engineers' Society of Milwaukee

The regular monthly meeting of the Engineers' Society of Milwaukee was held under the auspices of the Milwaukee section of the American Society of Mechanical Engineers on Wednesday evening, Jan. 14, 1920, in the assembly room of the Athletic Club. The society was addressed by Max Rotter, consulting engineer for the Busch-Sulzer Bros. Diesel Engine Co., St. Louis, Mo. He gave an illustrated talk on "Diesel Engines with Particular Reference to Recent Two-Cycle Engines." Mr. Rotter was for a number of years consulting engineer for the Allis-Chalmers Manufacturing Co.

Bessarabia Calls for American Plows

According to a report just received by the National Foreign Trade Council from the director of industry and commerce of Bessarabia, there is a widespread demand in that market for American agricultural machinery. It is estimated that over 30,000 plows are needed at once. Very high prices are also being paid for spades, shovels, rakes, sickles, scythes, forks, weeders and winnowing machines.

On account of the lack of overseas transportation, this country has been unable to export any of its produce and to import the manufactured goods which are so urgently needed. With the establishment of direct lines from the United States to the Near East, American exporters will find it worth while to make a careful study of this market.

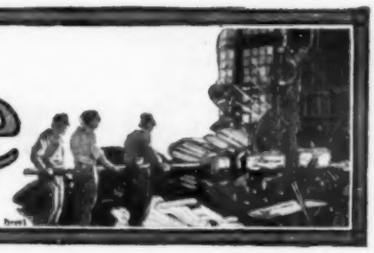
There is a great shortage of rolling stock for the railroads. Of 310 locomotives which Bessarabia possesses, only seventy-four can be utilized. Only half of the 3,000 freight cars are fit for service.

Janette Manufacturing Company Moves Into New Building

The Janette Manufacturing Co. has moved into its new factory building at 556-558 West Monroe St., Chicago, Ill. This is a seven-story and basement building, comprising a floor space of 60,000 sq.ft. The main floor will be used for offices and shipping department; the second floor for engineering and drafting room, and restaurant; and the five top floors will be used for manufacturing electric motors and generators.

Industrial Forge

News Editor



One Million Pounds of Tool Steel Offered for Sale

Approximately 1,000,000 lb. of tool steel are being offered for sale by the surplus property division, Office of the Quartermaster General of the Army, bids for which will close Feb. 17, 1920.

Included in this quantity are the following items located at Baltimore, Md.: 89,600 lb. of flat bars, 17 ft. long; 170,210 lb. of square, 18-ft. bars; and 274,655 lb. of hexagonal bars. More than 225,000 lb. of annealed round bars, ⅜ in. in diameter, are also being offered for sale in the same lot.

In addition, smaller lots of high-speed steel, manufactured by E. T. Ward & Sons, Raeburn, Pa., mostly 18 per cent tungsten, will be submitted for sale under sealed proposals. Bids may be submitted for any quantity above one bar to any of the district zone supply offices.

Full information regarding the material, places of inspection, conditions regulating purchases and specifications may be obtained from the surplus property division, Office of the Quartermaster General of the Army, Washington, D. C.

Would Transfer Surplus Machine Tools to Vocational Education Board

Representative Kahn, chairman of the Committee on Military Affairs of the House, has introduced a bill providing for the transfer to the Federal Board for Vocational Education "such machines, appliances, tools and equipment pertaining to the military establishment that may be found surplus and no longer required for military purposes and which the chairman of the Board for Vocational Education shall certify to be needed for the purpose of providing vocational rehabilitation for discharged disabled soldiers, sailors and marines." The transfer is left to the discretion of the Secretary of War.

Canada Gets Large Order from Belgium for Railway Equipment

An order for ten million dollars worth of railway equipment has been received by Canada from Belgium. This order is subject to arrangement of credit facilities under the new plan of specific accommodation to be granted by the Canadian Government where needed.

The order, which comes from the Belgian Minister of War to the Canadian Trade Commission, is for fifteen locomotives and three thousand cars. It is expected to be distributed among Montreal Locomotive Works, Kingston Locomotive Works, National Steel Car Company, Canadian Allis-Chalmers and other concerns which have been negotiating with the Belgian authorities for some time.

Erwin Frudden Appointed Chief Engineer Hart-Parr Company

Erwin Frudden has been appointed chief engineer of the Hart-Parr Co., Charles City, Iowa. Before accepting this position, Mr. Fudden was the chief engineer of the Buda Motor Co. at

ERWIN FRUDDEN

Harvey, Illinois. He was formerly in charge of engineering and production at the Parrott Tractor Co. During the war Mr. Frudden was a captain in charge of production of all automobile equipment for the Army in the New York zone.

Meeting of Engineers' Club of Cincinnati

"The Evolution of Automotive Electrical Ignition" was the subject of a talk by R. C. Fryer, superintendent of the garage of the Union Gas and Electric Co., before the Engineers' Club of Cincinnati on Thursday, Jan. 15.

School Requisition for 2,000 Machine Tools

Army reconstruction schools, which have undertaken the task of instructing disabled soldiers and sailors along technical lines, have requisitioned the Director of Sales of the War Department for 2,000 machine tools, available for educational purposes under the Caldwell Act.

Railroad Legislation Pending Before Congress

At the annual dinner of the Chamber of Commerce of Buffalo on Jan. 15, 1920, Thomas De Witt Cuyler, chairman of the Association of Railway Executives, discussed the railroad legislation pending before Congress. We present an abstract of his remarks to indicate the attitude of the professional railroad men of the country on a very important matter.

For two years now, the Government has operated the roads. When they were taken over, the general belief was that the great question to be settled was whether they would return to private ownership or remain forever in the possession of the Government. That question now is not a pressing one. Government operation for the two years has convinced the country in every quarter that public ownership is not desirable and that the roads should and can be operated by their owners.

The question, therefore, is how shall they be returned. Shall they be returned under the laws that existed prior to their taking over by the Government or shall such legislation be enacted as will enable the owners to operate their properties for the benefit of the public and their own profit? In other words, are the laws to be broad and strong enough to maintain the roads, provide the cost of operation, necessary additions and betterments, a fair return on the capital invested and a system of credit in the future that will provide for betterments and extensions that will be required incessantly for all time to come?

Any measure of legislation that falls short of this will be inadequate and will tend ultimately to government ownership.

To meet this situation arising from the return of the railroads on March 1st, two bills have been introduced into Congress; one in the House of Representatives known as the Esch bill; and the other in the Senate known as the Cummins bill.

The Esch bill proceeds generally on the theory that the Interstate Commerce Commission, whatever its shortcomings have been in the past, shall be the arbiter of the fate of the railroads in the future. They shall be the rate-makers, and in fact, the absolute controlling body over the railroads. But there is no adequate rule of rate-making provided in the Esch bill to guide the Interstate Commerce Commission, and so we are left to

its judgment and discretion solely as to just what the railroads need. Nor is there any adequate provision for dealing with labor. The bill in point of fact while proceeding on the sound principle that a Government guarantee should not go with private ownership, does not, in lieu of such guarantee, provide any proper rule of rate making. If, therefore, the Esch bill is not improved—and I am free to say that it can be improved upon the foundations laid down by the Committee—it would soon bring us to the same condition, as to credit and the inability of the railroads financially to protect themselves, that existed just before the war began.

On the other hand, the Cummins bill practically provides for a guarantee, but not an adequate one. The provision is that the roads shall receive not more than 5½ per cent return on their property investment and an additional one-half per cent for additions and betterments, and then proceeds to provide that all net earnings over 6 per cent shall be divided in certain proportions among the roads not earning this excess amount and the Government.

In other words, for the first time, so far as I am aware, in our country, the socialistic doctrine is introduced, that those who make their earnings under the law and as a result of the law by wise and proper management, shall surrender a portion of these earnings for the benefit of those who have been less fortunate. It is hard to see how such a provision can be enacted constitutionally, but even assuming that such a provision would be lawful, many of us feel that it violates the sound economic laws upon which this country was built and has prospered. If you once start the principle that the roads must give up a certain portion of their earnings for the benefit of others, the doctrine, socialistic in the extreme, will spread to other industries.

If the roads are to be deprived of reasons for initiative and the incentive to make the very best earnings they can, their enterprise will be stifled and the roads will not be maintained and improved in a manner adequate for their proper operation.

Nor could railroad credit be established on such a basis—at least so far as stock investment is concerned. What investor would buy railroad stocks with knowledge that their dividends are limited, and more than that, jeopardized by the possible inability of the roads to maintain and improve their properties? And where would be the incentive for the development of the country, a considerable portion of which is still in its infancy? New lines would rarely be built.

There are other features of the Cummins bill that are wise and beneficial. The provision as to a Transportation Board, made up of high-class men, whose duty shall be to study the transportation system of the country and recommend to the Interstate Commerce Commission what a proper rate would be in order to maintain the roads as they should be maintained, is a wise one. The provisions as to strikes, while extremely drastic, lay the foundation for some law whereby strikes will be curtailed and arbitration insisted upon.

The proposals of the Railway Executives proceed on the assumption that the American people want the railroad companies to be private enterprises under Government control.

They provide for a Board of Transportation largely similar to the provision in the Cummins bill, but with greater powers.

They make the Interstate Commerce Commission a judicial body and take away to a considerable extent its administrative functions.

They provide that intra-state rates shall be subordinate to and not in conflict with the interstate rates.

They provide that it is the duty of the Board of Transportation to see to it and certify to the Interstate Commerce Commission that the return received by the railroads shall be adequate to meet their operating expenses, including the cost of labor, material and supplies, interest and dividends on present capitalization and indebtedness and credit for future borrowing to meet the needs of the roads as to improvements and extension.

An address has recently been delivered by the present Director General of Railroads before the Bar Association of New York, in which he proposes that all the roads of the country shall be consolidated into a few great systems and that Government control shall continue until this is accomplished. I cannot believe that such a consolidation over night would be either wise or beneficial.

The consensus of opinion of the railroad men of the country is that actual or potential competition between strong, well-balanced railroad systems spells progress and efficiency. The consolidation of lesser lines needed to fill out or to create these great systems should certainly be permitted, under Government approval, but it is a grave question if the country would be well served by a few great systems, the operation of which would tend to stifle enterprise and become perfunctory in its nature.

You may by improvident legislation destroy securities and the financial interests of the roads, but you cannot destroy the railroads without destroying the country. This transportation system is its most vital interest and it should be adequate and capable of enlargement whenever the demands of the country require it. Therefore, it is to that vision that I desire to direct your thought. It is your fight as much and more than the fight of the owners of railroad securities, and if you are to prosper in your business, if your country is to grow, you must see to it that transportation is provided.

A Gasfitter's Invention for Armless Men

GEORGE THOMAS, gasfitter of Edinborough Co., England, recently gave a demonstration of an appliance which he has invented for the use of armless men. It is reported that this machine, which is worked by the feet, can do anything a man can do with two arms. Mr. Thomas, the inventor, is shown seated in the accompanying illustration, demonstrating how the machine can be used for writing.

Business Conditions in England

FROM OUR LONDON CORRESPONDENT

LONDON, JAN. 2, 1920.

Writing during the lull which occurs at the opening of the year, one cannot help being struck by the different commercial conditions which prevail in Great Britain as compared with the pre-war period, and more particularly with the earlier section of the war period itself. Formerly, it was the seller that competed for the favor of the buyer; now, on the contrary, owing largely doubtless to the recognized shortage of supplies, buyers are competing one with another, and the natural tendency is for prices to rise.

Another unusual feature is that, to support demands for increased wages, workmen are now tending to criticize those in charge of industry on the ground that they are not sufficiently alert in the use of improved means and methods of production and transport. Certain workers, the miners for instance, have in fact burned their boats as regards opposition to the introduction of machinery. The whole of Great Britain looks forward to a year of prosperity, as measured at least by receipt of orders at high prices. Many materials are scarce and dear and such actions as the impending increase by the government in railway freight charges must tend to limit trade. But apart from labor troubles, one of the main handicaps likely to be experienced is the relative shortage of machinery for production. Workers, too, are pressing, for the reasons hinted at, for more efficient methods of distribution of goods, and a public inquiry is to be held into the economic effect of the 16s. standard daily wage demanded for the dock and riverside workers. The inquiry will probably be held as the result of the industrial courts act which was passed at the last session of parliament and, at any rate if the workpeople can have their way, the scope of the inquiry will be wide.

No one has yet estimated closely the effect of the change in railway rates on selling prices, but it is very generally intimated that the ultimate increase will be considerably more than that due to the raised rates. The figure of £1 a ton has been mentioned in connection with pig iron, but this has rather reference to increased charges for coke. In Birmingham it has been reported that certain steel billets from America are being offered considerably below the charges of Welsh makers. To illustrate the advance in prices, it may be mentioned that in the Glasgow district plates for ships and boilers are at between three and four times the pre-war prices, with no present hope of reduction.

The ease with which orders can be obtained for the home market has led to the danger that the importance of foreign trade for the prosperity of Great Britain may be overlooked in the desire for easy profits. The Department of Overseas Trade is therefore pressing forward commercial exhibitions of goods suited to given markets, these exhibitions being moved from place to place, outside Great Britain, of course, in order to keep merchants and others in exhibition districts well educated as to British products. In addition, it is proposed that showrooms to exhibit British manufactures shall be opened in some twenty or thirty of the chief cities of the European continent, exhibitions of goods being arranged in rotation; that is, the class of exhibit shown would not be permanent for any particular place. A great war exhibition will be held in the Crystal Palace in May next, where some 50,000 sq.ft. of space will be devoted to engineering and electrical objects, and further, a special oil exhibition will be organized. Previous to this, however, a British industries fair will be held in the same place, and similar fairs in Birmingham and Glasgow, and the occasion will be taken to see how far the idea of peripatetic exhibitions and established continental showrooms is likely to be supported. The department concerned will work, if necessary, in conjunction with organizations already in existence to further British export. The Federation of British Industries is particularly mentioned. This federation has now taken over the British-China trade bureau. The latter has an organization throughout south China and, it is asserted, "exercises a controlling influence over nearly 100 newspapers published in the vernacular." Free of charge, it introduces British manufacturers to merchants in China.

Announcement is made that a census of production will be taken in Great Britain in 1921. It will not be all-embracing, but the engineering trades are of course included. Concerns employing, on an average, not more than five persons, exclusive of officers of the company or members of the firm, will not have to make returns, but must make signed declarations as regards the average number of persons employed during 1920.

To deal with the handicap of unemployment, the government proposes to extend the national unemployment insurance scheme so that it will cover almost every employed person between the ages of sixteen and seventy. The wage limit has not yet been stated, but the contributions will be at an equal rate for employer and employed — 3d. for each man and 2½d. for each woman, with one-third of the combined contribution, that is, 2d. in the case of each man, payable by the state.

Reference has been made in these columns to the inquiry instituted by the British Engineering Standards Association on limits and it will be recalled that the committee concerned was unable to make a definite recommendation, though it was clear that the hole rather than the shaft should

To Technical Educators of the Country

OHIO and Michigan schools are leading in the filing of the questionnaires requisite to the securing of machine tools under the Caldwell Bill. Consequently, they will be in a position to obtain first choice from the available supply.

If you have not received your questionnaire write at once to the Director of Sales, Munitions Building, Washington, D. C., and ask for it. If you have received it and have not returned it, do so at once. We urge this action because there seems to be a strong possibility that the supply may not be large enough to go round.

* * *

The *American Machinist* has put up a strong fight to make these tools available for you and now that success has crowned our efforts we want the distribution to be as widespread as possible. A copy of the questionnaire and letter of instructions from the Director of Sales appeared in our issue of Jan. 1.

* * *

If you are loaded up with worn-out tools why not sell them for what you can get in the second-hand market, where prices are now high, and apply the receipts on the 15 per cent purchase price of the new and up-to-date tools of the War Department? Here is a golden opportunity to exchange old tools for new without spending any of the cash in your limited equipment funds.

The Director has just issued a bulletin describing 4,000 tools. Ask for a copy when you write him. Once again, don't delay if you want your share of this valuable equipment! Remember the early bird!

in the general opinion be the basis. It was known that about the same time the German engineering industry had been investigating the same subject, though with what result was not clear in Great Britain. The editor of the European edition of this journal therefore wrote to the Verein Deutsche Ingenieure, Berlin, and in reply heard that, to translate: "In German industry, so far, the following final resolutions have been adopted: (1) The temperature of reference is 20 deg. Celsius. (2) The zero line is the limit line; that is, the nominal dimension for the shaft is the maximum dimension of the same from which deviations are only allowed downward. For the bore the nominal dimension is the smallest dimension of bore. Deviations are only permissible upward." What was, however, astonishing was the further suggestion that in all probability it is the standard shaft that will be adopted, supplemented by the statement that "those that were hitherto partisans of the standard bore in German industry incline more and more to the view that the standard shaft is the right one."

Trade Currents From New York, Cleveland, and Chicago

NEW YORK LETTER

An otherwise eventless week in the local machine-tool field is relieved by the announcement of several expected price increases, a heavy demand for small woodworking machinery, and considerable improvement in deliveries.

Certain makes of planing machines were advanced 15 per cent, milling machines soared to 10 per cent above last quotations, boring-mills were increased 20 per cent and those "in the know" say the "end is not yet."

Deliveries are improving. A representative firm offers spot delivery on No. 2 milling machines, thirty to forty-five days on No. 1 milling machines and two to three weeks on standard cutting machines. Other firms make very favorable delivery dates, so, based on current reports, there should be an improvement in deliveries shortly.

Small, motor-driven machines of all types are leading in inquiries among local dealers. One of the larger houses issued a recent catalog supplement featuring fractional horsepower motor grinding and buffing machines and the like, and reports that the sales of this class of equipment are reaching record proportions.

Small group orders, and singles still dominate sales. There is, however, an air of expectancy based on recent industrial events, that the next few weeks will see some unusually heavy unit purchases. A recent order to the Submarine Boat Co. for thirty-two ships of 5,500 tons each may reasonably result in a large list of machine tools.

The building trades are again active after three years of "innocuous desuetude," and with $150,000,000 worth of construction in sight, the machine-tool trade obviously will benefit from the mechanical auxiliary end.

Change-overs from coal to fuel oil by the larger fuel consumers in New York City are now permitted by the authorities. The Singer Building, and the Hotel Astor are converting their coal burning plants. With the thousands of change-overs that will certainly follow this pioneering of the buildings mentioned, a vast industry in fuel-oil burners and their auxiliaries will pay handsome tribute to local machine-tool dealers.

Pneumatic tools are going strong, particularly in export trade. For the month of November, air compressors valued at $125,634 went overseas; and a steady stream of attendant tools is following.

Exports of machine tools from this port in November, most of them bought locally, reached the substantial mark of $2,925,708. Of this amount, $404,390 went for lathes. Other machine tools brought $660,966. For metal-working machinery, exclusive of, but allied with, machine tools proper, $1,860,352 was received. This was November, 1919, and there has been a substantial increase in the export trade since then.

Little change is noted in the used-machine-tool situation. There is a tendency among dealers to buy shops as a unit, rather than individual machines. The demand for all lines is steady, with a substantial volume of business evident.

The Watervliet Arsenal is in the New York market with used equipment. The standard machines sell readily at good prices, but specials are sluggish.

The general tone of the machine-tool market is good. Many concerns are sold out on their factory allotments, and are forced to refuse im-

Domestic Exports of Metal-Working Machinery from the United States by Countries During November, 1919

Countries	491 Lathes	492 Other Machine Tools	493 Sharpening and Grinding Machines	495 All Other
Belgium	129,837	8,305	6,924	69,351
Denmark	7,033	9,080	1,064	28,632
Finland				14,955
France	36,830	143,968	112,555	1,021,842
Gibraltar				4,000
Greece		1,073		72
Italy	945	53,772	17,500	42,096
Netherlands	13,862	11,808		20,639
Norway	717	1,062	1,846	5,502
Portugal				2,555
Spain	38,056	11,131	3,548	11,995
Sweden	19,421	2,212	9,974	24,827
Switzerland	125	324	706	2,450
Turkey in Europe	441			
England	112,499	414,043	163,396	550,841
Scotland		403		2,815
Ireland		1,336		
Canada	61,118	196,592	88,125	210,240
Costa Rica	1,665			70
Guatemala		56	138	569
Honduras				88
Nicaragua		450		183
Panama		335		
Salvador		74		
Mexico	4,666	8,716	419	22,066
Newfoundland and Labrador		221		
Jamaica	1,581	138		625
Trinidad and Tabago	48	291	6	
Other British West Indies	903			
Cuba	16,276	49,274	400	24,567
Danish West Indies		64		
French West Indies	1,164	42		
Haiti			100	37
Dominican Republic	842	57		486
Argentina	5,504	11,685	5,857	18,711
Bolivia		22		
Brazil	4 808	7,583	1,234	4,381
Chile	700	2,790	583	75,206
Colombia		833	295	576
Ecuador		148		
British Guiana	242			
Dutch Guiana			58	
French Guiana		30	180	
Peru	2,754	2,393	18	11,009
Uruguay	3,175	1,199		657
Venezuela	6,900		142	300
China	3,585	2,081	520	11,592
British India	3,443	5,121	255	8,223
Straits Settlements		4,319		
Dutch East Indies	16,804	1,311	2,125	12,740
Hongkong		40		3,890
Japan	21,404	31,075	12,182	190,342
Russia in Asia		586		4,456
Australia	1,776	9,146	2,326	9,457
New Zealand	8,683	1,960	504	2,776
French Oceania				17
Phillippine Islands	10,616	8,106	764	16,027
Belgian Kongo				1,382
British West Africa	960			
British South Africa	8,418	1,289	5,235	16,453
French Africa				1,669
Portugese Africa				1,354
Total	647,801	1,006,544	438,979	2,452,721

mediate business. Credits shape up well, and sales are more a matter of order taking than effort at present.

Cleveland Letter

The first month of the new year finds almost weekly improvement in the machinery market of the Cleveland and northern Ohio districts. There is a marked increase in inquiries followed by orders, and likewise caution among those interests toward whom the machinery trade has been looking as probable large buyers.

Considerable stress has been laid by the automobile industry and those interests allied with it on the tremendous output that was scheduled for 1920. These assertions still are forthcoming and the machine-tool trade is ready to cope with the demand when it materializes.

While the machinery business is good, because of a large volume of business, orders are comparatively small, and generally range from five or six machines down to ones and twos. Inquiries are being made by the General Electric Company, but just how extensive the requirements are to be for this concern is not yet announced. Meanwhile, general manufacturing firms continue to be the principal buyers of equipment in this market.

It is believed among some machinery interests in this locality that, while it is unusual to do so, automobile producers, at least some of the local car builders, may base their immediate future activities upon the amount of prospective business that will have developed out of the Cleveland Automobile Show, being held here during the week of Jan. 19. It is claimed by many salesmen at the show that a larger number of actual orders for new cars have been booked at this show than during any previous similar exhibition. If this is true, machinery interests believe increased production of cars will start immediately, and that the requirements for equipment will be in proportion.

Machinery producers in this district and others which have representatives and retail establishments in Cleveland, all report slow deliveries. In some instances representatives find the demand for immediate delivery so keen that plant managers are willing to take machines from the floor. This will be done in some instances where it is found delivery cannot be made from the factories in less than thirty days.

Considerable interest is manifested by machine-tool men here in the announcement that the Overland automobile interests plan to establish a plant in England for the purpose of producing 25,000 cars a year there. The production will be by Willys-Overland-Crossley Company. E. B. Jackson, vice president of the Overland, has recently returned from England where an arrangement was made to co-operate with the Crossley Motor Works. At the start, it is explained, American foremen and American parts will enter into the English production. The project is admittedly too incipient to foretell what, if any, American-made machinery will be required for this enterprise.

Chicago Letter

The third week in January opens with dealers reporting excellent business. One concern considers this the busiest week in its history, but other sales offices notice a very slight let-up from the high pressure maintained during the past three months. Deliveries are getting worse rather than better, and back orders are piling higher every day. Several dealers state that new orders booked so far in January exceed deliveries by 30 per cent. This proportion is even higher in some lines.

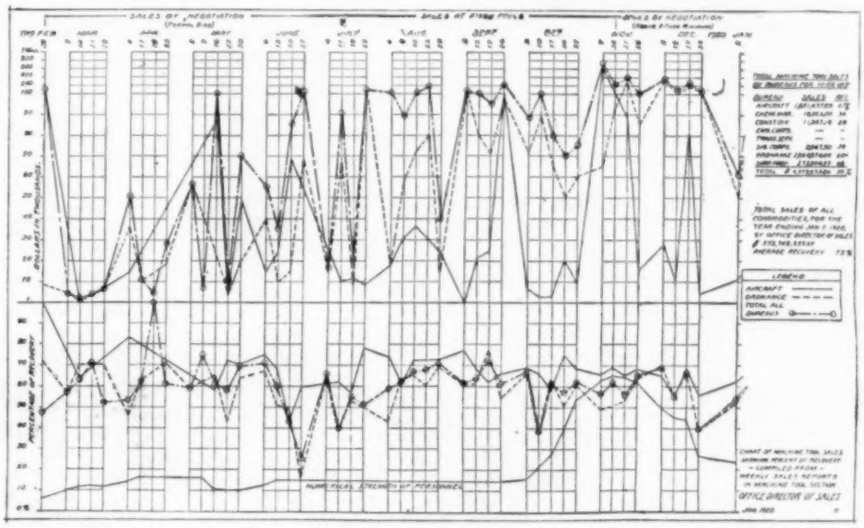


CHART OF MACHINE TOOL SALES SHOWING PER CENT OF RECOVERY

Prices of heavy equipment advanced last week. Practically all makes of planing machines and turret lathes were advanced 12½ per cent. Boring mills went up 10 per cent. Every item in the machinery line is now either as high or higher than during the price peak reached in 1918. The Government is also taking advantage of the demand, and tools being sold from the Quartermaster's Store here have also been marked up from 80 per cent of full list, for new, to 90 per cent.

This Government tool sale which has been carried on at the old Symington Corporation plant for some months is still in progress. The immense floor remains well covered, but no shaping, milling, planing machines nor radial drills are left. Callers are numerous but, as the items most in demand are all sold, actual sales are not nearly as heavy as they were in October and November. When it is considered that the sale prices are based on present list prices of similar tools, and that these current lists are all equal to or higher than those in effect at the time the Army purchased the machines, it will be seen that a very good price is being obtained.

The Studebaker Corporation continues in the market for various classes of tools and the Worthington Pump Company is buying quite heavily. As an evidence of activity in the automobile industry, it was reported, after the January meeting of the board of directors of the Buick Motor Company, in Flint, Mich., that the company would immediately proceed with the expenditure of over seven million dollars on additional plant equipment at Flint, to include nine new buildings and three additions, and of three million dollars on an assembly plant in St. Louis, Mo. All the motor-car builders are constantly in the market for a wide variety of tools.

The Kewanee Boiler Co. announced its intention of erecting a $500,000 warehouse and salesroom on the west side. A contract was let for the construction of a fifteen-story building by the Chicago *Tribune;* which will occupy a portion of the building for its own plant, and rent the remainder for light manufacturing.

Control of German Export Trade

From Our German Correspondent

In order to prevent German firms from selling their export goods below market prices, a governmental decree related to the control of German export trade will be promulgated shortly. This decree will empower the federal minister of economics to prohibit the export of German goods by granting full authority to the federal commissioner for export and import, or any other competent board, to use his own discretion with regard to export permits.

With a view of accelerating the working of the official machinery and eliminating red tape, extensive changes in the administration are contemplated. The federal commissioner will be authorized to vest the various foreign trade boards or other bodies with far-reaching power; besides, the existing "Central Bureaux for Export Permits" will be superseded by foreign trade boards.

In granting export and import permits certain conditions will be stipulated as, for instance, re-export of imported goods, minimum prices or certain modes of payment for export goods, etc. Fees will be charged to cover the expenses the state incurs in administrating the foreign trade control; the foreign trade boards will likewise be entitled to charge certain fees for their operation.

Another stipulation in granting export permits will be that a certain amount of the surplus profits realized by the exporters, due to the required minimum prices, will have to be handed over to the state. This amount will vary according to the industrial districts and will be spent for industrial welfare work. The penalties for exporting prohibited goods will be made even more severe and any contravention of the conditions under which the export permit was granted will also be punishable. For both offenses a penalty of at least one month in prison will be inflicted unless a still more severe punishment is provided by the existing penal code. Besides, a fine of at least three times the value of the goods in question will be imposed. A contravention of the decree caused by negligence will also be punishable and all goods handled in illicit trade are liable to seizure by the government with the owner forfeiting all claims as regards compensation.

National Copper and Smelting Co. Leases a Plant

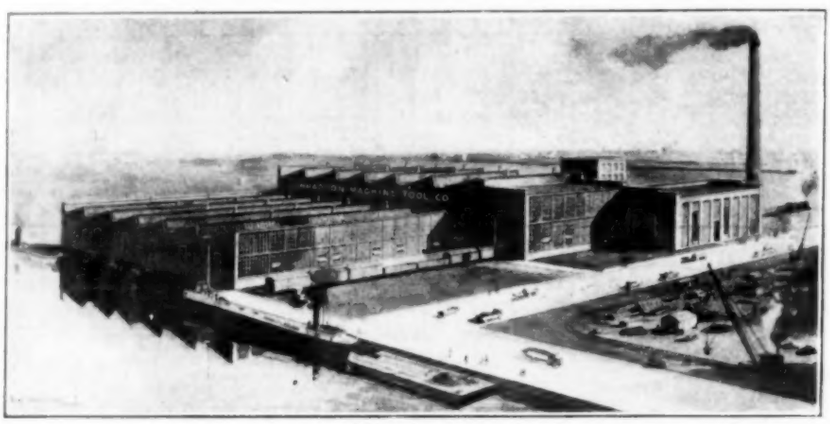
The National Copper and Smelting Co. leased part of the property of the Babin-Sill Co., Euclid Ave., Cincinnati, Ohio, for the purpose of manufacturing small seamless copper and brass tubing. The company already has a plant in Detroit, according to F. G. Carpenter, Illuminating Building. Henry Osborn, president of the American Multigraph Co. and president of the Cleveland Brass and Copper Mills, Inc., is a director in the National concern.

Prospective Railway and Machinery Purchases in Russia

Announcement is made of the formation of the buying committee of the Economic and Technical Association of the liberated Provinces of Russia, with offices at 116 Bolshaya Sandovaya St., Rostov-on-Don, Russia. The British vice-consul at the above place reports that this is an organization composed of several of the railway companies, government and industrial agencies and other establishments which is combined with a capital of 50,000,000 roubles. The purpose of the association is to purchase various kinds of machinery and railway supplies and other goods required by the individual members of the organization. Reports state that some of the backers of the proposition are very influential and the combination is looked upon as being a good omen for the future trade possibilities in South Russia.

New Plant of the Conradson Machine Tool Co.

The Conradson Machine Tool Co., Green Bay, Wis., has recently occupied its new machine-tool plant shown in the accompanying illustration. The construction of this plant was started in the spring of 1918. The articles of incorporation recently filed for this company show C. M. Conradson as president. Mr. Conradson is well known in the machine-tool field and has lately been engaged in general consulting work in tool design.



NEW PLANT OF CONRADSON MACHINE TOOL COMPANY

This new plant is located on a site of twelve acres on the outskirts of Green Bay, and consists of a machine shop, a main erecting bay, a power house, a heating plant, and an office building. The equipment has been installed and production is under way. The machine-shop equipment is modern and consists chiefly of individual motor-driven machine tools, all of well-known makes.

Joseph T. Ryerson & Sons, the selling representatives, will market the plain and universal milling machines, selective head lathes, planing machines and radial drilling machines which will be built at this new plant under the trade name of "Ryerson-Conradson."

British War-Time Plants Take Up New Lines of Manufacture

Advices just received from London indicate how various British industrial firms are turning their war-time plant extensions into new lines of manufacturing, particularly in the construction of locomotives and railway equipment. One of the largest ship and armament building companies in Great Britain has converted an extensive shell plant into locomotive shops intended to be the largest and most modern shops in the British Empire.

The conversion of this plant, which had manufactured 14,500,000 shells during the war, and the production of its first main line locomotive were accomplished within a year from the Armistice.

The same company has acquired a plant for automobile manufacture on a large scale, has transformed one of its gun and gun-carriage shops into marine-engine works, turned another war-material shop into an iron foundry, diverted gun forges to the production of marine shafting, altered armor-plate mills to manufacture ship and locomotive plates, rearranged its shipyards so that their greatest output is now merchant instead of war craft, acquired an electrical works for building its own power machinery, and also expanding in the construction of pumping engines, cranes, dock gates and similar output. Another large British concern, formerly identified especially with the manufacture of harvesting machinery, has converted a munition works into a plant for the production on a very large scale of railway cars.

This same company recently received an order for Pullman cars from one of the leading British railway companies, whose equipment did not include this character of rolling stock. These new Pullmans are to be superior to any other railway vehicles now in service in the United Kingdom. Orders are also in hand for some 4,400 all-steel covered freight cars for the Indian State Railways, and various types of freight equipment for several British railways.

A Sheffield concern, which during the war had been manufacturing engine parts for airplanes, is now extensively engaged in the output of light-gage locomotives and model locomotives and steam engines.

Machinery Parts Needed in Brazil

One of the greatest drawbacks of industrial development in Brazil has been the difficulty of obtaining spare machinery parts. Machinery in many cases has been worked until worn out and useless, or after long waiting spare parts have locally been supplied, rarely with successful results, and the output of manufactured goods has suffered alike in quality and volume.

What is true of Brazil is more or less true of all parts of South America in which industrialism has made progress during the past few years. One of the chief needs of these countries is some system by which spare parts

(*Continued on Page* 268b)

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Milling Machine, Universal.

Alma Machine Wks., Liversedge, Eng.

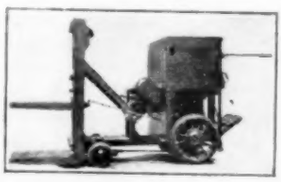
"American Machinist" (Eng. Edition), Nov. 15, 1919.

Has 18 spindle speeds; Morse taper No. 5; 3-step cone, 13 in. to 16 in. in diameter; belt, 4 in. wide; table, 60 x 12 in.; working surface, 54 x 12 in.; is mounted on swivel slide and locked by three bolts; power feed acts with table swiveled 45 deg. to either side; range, 36 x 11 x 21 in.; feed changes by gear box; floor space, 9 ft. 4 in. x 7 ft.; net weight, 7400 lb.

Truck, Tiering.

Elwell-Parker Electric Co., Cleveland, Ohio.

"American Machinist," Nov. 6, 1919.

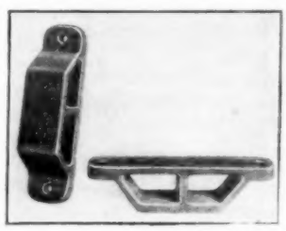


Truck is driven by an electric motor from storage batteries; drive is by worm gearing. Hoist is operated by a separate inclosed-motor, direct-connected to hoisting drum. Platform uprights provided with rollers, guided by upright channel irons. Limit switch stops the elevator at extremes of travel. Wheel base is short; all four wheels used for steering. All the wheels have rubber tires. Specifications: Speeds: 3 in either direction, 375 to 525 ft. per minute; load capacity, 1000 lb.; minimum distance, platform to floor, 2½ in.; lifting height, 5 to 6 ft.

Feet for Transveyor Skids.

Cowan Truck Co., Holyoke, Mass.

"American Machinist," Nov. 6, 1919.

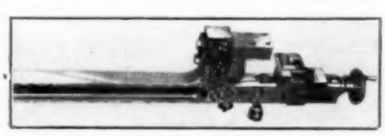


The feet are made of cast iron, with broad surface to floor. Two bolt holes are provided to fasten to skid; it is claimed that their use will double life of skids.

Re-turning Tool, Crankpin.

Sawyer-Weber Tool Manufacturing Co., 350 South Alameda St., Los Angeles, Calif.

"American Machinist," Nov. 6, 1919.



Different form cutters are furnished to suit the lengths of crankpins to be re-turned.

This tool is made in four sizes as follows: No. 1, for pins 1¼ to 3 in. in diameter by 1½ to 3 in. long; No. 2, for pins 1½ to 3 in. in diameter by 2 to 4 in. long; No. 3, for pins 1¾ to 4 in. in diameter by 2¾ to 5 in. long, and No. 4, for pins 3 to 6 in. in diameter by 3½ to 7 in. long.

..icator, Liquid, Micrometer.

T. S. Booth & Co., Manchester Road, Castleson, Eng.

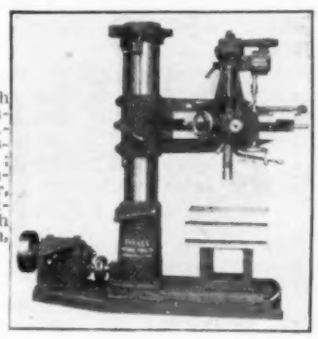
"American Machinist" (Eng. Edition), Nov. 15, 1919.

Works on the principle of displacement of a liquid by the spindle. When liquid rises in tube the air will pass through the valve at top. Should indicator be inverted, or liquid rise to top of tube, valve will automatically close and prevent liquid escaping. Two or more readings can be had by the same indicator. Graduations on the tubes shown read 1 in. movement for 0.001 in. which makes it possible to read to 0.000025 in., and the tube in the indicator reads $\frac{5}{16}$ in. movement for 0.001 in. Changing tubes is only a matter of seconds.

Drilling Machine, Radial, Simplex.

Dreses Machine Tool Co., Cincinnati, Ohio.

"American Machinist," Nov. 6, 1919.



These machines are built with 2½- and 3-ft. arms, and the principle dimensions of the 2½-ft.-arm machine are: Maximum distance from base to spindle, 51 in.; traverse of spindle, 11 in.; diameter of column, 9 in.; feeds, four, 0.007 to 0.018 in.; speeds, eighteen, 83 to 575 r.p.m.; weight, with 2½-ft. arm, 3100 lb.; 3-ft. arm, 3400 lb.

Heater, Electric Rivet.

General Electric Co., Schenectady, N. Y.

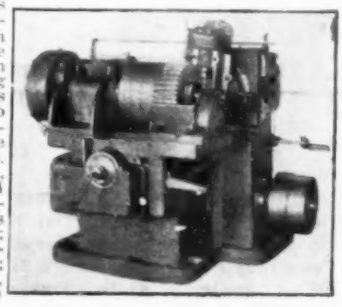
"American Machinist," Nov. 6, 1919.

Transformer mounted on angle-iron legs; can be fitted with wheels; two copper bars fitted with heavy air-cooled electrodes of cast copper and underneath these a copper block act both as support and an electric connection for two rivets in series. Sizes of heaters are 5-kw. for rivets up to ⅜-in. diameter and 15-kw. for rivets up to ⅞-in. The 15-kw. in actual test heated 500 ½ x 1¼-in. rivets in one hour.

Gear-Generating Machine.

Donaldson & Fisher Manufacturing Co., Chicago, Ill.

"American Machinist," Nov. 6, 1919.



Will cut straight and helical gears, worms, wormwheels and will spline shafts. Headstock and tailstock mounted on heavy table; provision made by cross-slide, for moving them to or from hob for adjusting depth of cut. Crossfeed has micrometer dial reading to 0.005 in. Adjustable stops provided so that settings can be repeated. Table can be locked. Specifications: Capacity, gears 14 in. in diameter by 14 in. wide (or wider if so ordered); will cut cast-iron gears up to three diametral pitch; steel gears up to four diametral pitch; pulley, 14 x 3½ in.; speed, 350 r.p.m.; floor space, 54 x 67 in.; weight, 5500 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

can be obtained for replacing those worn out with as little delay as possible. A prominent industrialist of Sao Paulo urges that stocks of spare parts be maintained at Rio de Janciro. To some extent that is done already, but the stocks are not sufficiently large nor of wide enough variety to insure the customer of having his order filled from stock.

Several Hundred Tons of Machine Tools in the "Powhatan" Cargo

Delay in the transportation of between 400 and 500 tons of machine tools, purchased by Belgium from the War Department, was caused when the Army transport "Powhatan," which included in her cargo part of the Belgian consignment of machine tools, sprung a leak 700 miles east of New York.

Officials in Washington in charge of the transaction with Belgium believe that no damage was done to the machine tools, although the accident will considerably delay their arrival in Belgium.

Another shipment of the Belgian order of machine tools is expected to be made within the near future. A vessel is now being loaded in New York Harbor which will carry 2,000 additional tons of the order.

American Society of Civil Engineers Elects Officers

At the sixty-seventh annual convention of the American Society of Civil Engineers, which was held at the Engineering Societies' Building, 29 West Thirty-Ninth Street, New York, last week, Arthur Powell Davis, chief engineer of the United States Reclamation Service, was elected president for the year. New vice presidents elected were Robert A. Cummings, of Pittsburgh, and Francis Lee Stuart, of New York. Arthur Smith Tuttle, of New York, was re-elected treasurer.

New directors chosen include Carlton Greene and C. W. Hudson, of New York; John A. O'Connor, of Albany; J. C. Hoyt, of Washington; Anson Marston, of Ames, Iowa, and David C. Henry, of Portland, Ore. The annual convention will be held in Houston, Tex., in October.

A feature of the annual report was the honor roll of the society, which showed 1,823 members in the service of one or the other of the Allied armies during the war.

A Demand for American Machinery in Foreign Countries

Machinery manufacturers report a continued demand from foreign customers for American machinery. In addition to large shipments of both light and heavy industrial machinery to the Far East, there is a good demand from South America and the West Indies. South Americans are buying agricultural and mining machinery as well as equipment for large industrial enterprises. The orders from the West Indies are mostly for sugar-mill equipment, a large portion of which is new business. Greece and other southern European countries are placing orders for small marine engines and light agricultural machinery. Australian and South African machinery buyers are active. Both countries are advancing in industrial lines and are in need of much equipment.

Short News Notes

It is reported that the General Motors Co., Flint, Mich., will build a half million dollar drop forge plant at Lansing, Mich.

* * *

The Cincinnati Milling Machine Co., Cincinnati, Ohio, has announced an increase of 10 per cent on milling machines from No. 2 up.

* * *

The Bullard Machine Tool Co., Bridgeport, Conn., increased the price of boring mills 20 per cent. This is the first raise in price since Oct., 1918.

* * *

The H. H. Franklin Manufacturing Co., Syracuse, N. Y., which is largely increasing its plant, is in the market for $200,000 worth of machine tools.

Changes in Personnel of Westinghouse Air Brake Co.

J. R. Ellicott, manager of the Eastern district, has retired after a long service with the Westinghouse Air Brake Co. He will, however, act with the officers of the company in a consulting capacity. Mr. Ellicott will be succeeded by C. R. Ellicott. C. H. Beck, heretofore special representative of the Safety Car Devices Co., succeeds C. R. Ellicott as assistant Eastern manager, with headquarters in New York City.

With the promotion of E. A. Craig to the position of export manager, with headquarters in the Westinghouse Building, Pittsburgh, Robert Burgess, representative at Atlanta, becomes Southeastern manager, with headquarters in the Munsey Building, Washington, D. C.

A. K. Hohmyer, a representative of the company attached to the Chicago office, is promoted to the position of assistant Western manager.

J. B. Wright, assistant Southeastern manager, is made assistant district manager at Pittsburgh.

W. G. Kaylor, representative in the Eastern district, is appointed representative of the export department, with headquarters in New York City.

F. H. Parke, resident engineer, Southeastern district, is appointed general engineer with headquarters in the Westinghouse Building, Pittsburgh.

T. W. Newburn, assistant resident engineer, Southeastern district, becomes district engineer, Southeastern district, headquarters, Munsey Building, Washington, D. C.

J. C. McCune, special engineer, Wilmerding, is appointed assistant to district engineer, Eastern district, headquarters, 165 Broadway, New York City.

J. H. Woods of the commercial-engineering department, Wilmerding, is appointed engineer, export department, with headquarters in the Westinghouse Building, Pittsburgh.

Business Items

The Wittemann-Lewis Aircraft Co., Inc., Newark, N. J., has changed its address to Hasbrouck Heights, N. J.

The Grinnell Co., Inc., Providence, R. I., on Jan. 1, took over the sales force and contracting business of the General Fire Extinguisher Co.

The T. A. Willson & Co., Inc., Reading, Pa., has changed its name to the Willson Goggles, Inc. The ownership and personnel of the corporation remains the same.

The Cleveland Drop Forge Co., Cleveland, Ohio, has been chartered with a capital of $750,000 to operate a drop-forging plant. The incorporators are I. W. Sharp, H. S. Brady, S. C. Smith, H. P. Baker and A. Cullen.

The Victor Saw Works held its annual salesmen's convention at Springfield, Mass., on Jan. 2 and 3, 1920. The activities of the past year were reported and analyzed as were plans under consideration for the future.

The Gandy Belting Co., 726-40 West Pratt St., Baltimore, Md., will establish a branch at 549 Washington St., Chicago, Ill. Fielder I. Schillinberg, Jr., who has been in charge at the company's New York office, has been transferred to Chicago, where he will be manager of the new branch.

The Barnum-Richardson Co., Lime Rock, Conn., manufacturer of iron, has been purchased by Eugene E. Anderson, Sharon, Pa., who is representing a syndicate. The company has iron mines located in New York and Connecticut, the product of which has been largely used in the manufacture of car wheels.

The Cramp Manufacturing Co., 910 West Van Buren St., Chicago, Ill., has been capitalized for $50,000 to engage in the manufacture of precision tools. The incorporators are E. Brust, Paul Schmidt, C. Nebeser and J. Wright, all of whom have been identified with various small-tool manufacturing concerns.

John M. Howitt has opened a machinery business at 12 West Second St., Dayton, Ohio, and will carry a stock of machinery manufactured by the following firms: S. A. Potter Machine and Tool Co., bench plates; Greaves Klusman, engine lathes; John Steptoe Co., shaping and milling machines; Hoefer & Co., drilling machines and multiple spindle heads; Hannifin Manufacturing Co., air chucks; Kelly Reamer Co., reamers.

(*Continued on Page 268d*)

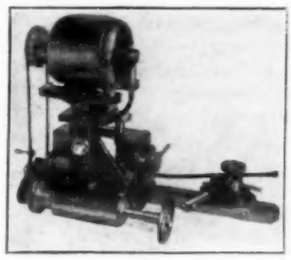
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Grinding Machine, Portable Universal

Lafayette Tool and Equipment Co., 21 South 12th St., Phila. Pa.

"American Machinist," Nov. 13-20, 1919



Adaptable to a wide range of light work; particularly recommended by the makers for threaded work—internal or external. Is said to grind to within 0.0001 in. all types of gages, taps and dies, reamers, cutters, etc. Can be used as a bench machine or in conjunction with a lathe or other machine tools. Is capable of grinding holes as small as $\frac{3}{8}$ in. in diameter by 8 in. in length; is convenient for grinding milling cutters while in position. Button dies may be ground, teeth and flutes, at one setting. Possible to obtain any angle desired as machine is adjustable horizontally $3\frac{1}{2}$ in., vertically $2\frac{1}{2}$ in. and angularly to 20 deg.; adjustments regulated by micrometer readings graduated to 0.001 inch.

Vise, Universal

New Britain Tool and Manufacturing Co., New Britain, Conn.

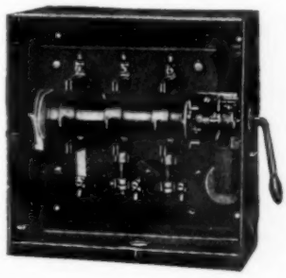
"American Machinist," Nov. 13-20, 1919

For use in milling and drilling machines, and in laying out work; it combines in one tool means of obtaining any angle. Is graduated and may be tilted to any angle from vertical to 10 deg. below horizontal. A circular boss cast upon the upper surface of the tilting member is graduated and receives the base of the vise which may be turned to any desired position. Any angle within the complete circle may be obtained in the horizontal plane, and this movement combined with available angles in the vertical plane enables the user to set his work in any position without tilting plates, angle plates, or straps and bolts. The jaws are removable, and are hardened and ground. They are $1\frac{1}{2}$ by $5\frac{1}{4}$ in. in size, and the complete tool weighs 55 pounds.

Switch, Safety Motor Starting

Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa.

"American Machinist," Nov. 13-20, 1919



Type WK-100 provides protection to both operator and motor; is designed for connecting single or polyphase alternating-current motors of from 1 to 20 hp., 250 and 550 volts, directly to the line without the use of auto-transformers or resistance. All mechanism with exception of operating handle inclosed in a steel box. The protective devices are easily accessible on opening a door in the cover, but this door can not be opened except when the switch is in the "off" position.

Holder, Easy Lock for Reamers and Cutters

S. & C. Manufacturing Co., Detroit, Mich.

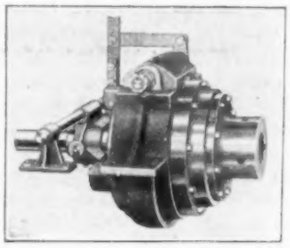
"American Machinist," Nov. 13-20, 1919

This quick-acting holder for reamers and cutters is designed to hold such tools securely or release them quick'y through hand manipulation only, and without the use of hammers, wrenches or other mechanical means. Has a variety of uses, such as holding interchangeable counterbores, tapered bridge reamers or floating shell reamers. In the latter case a separate shank is required in connection with the easy-lock holder. The holder is made in four sizes to accommodate ten different sizes of shanks which will handle the entire line of standard shell reamers.

Reversing Gear

Snow & Petrelli Manufacturing Co., New Haven, Conn.

"American Machinist," Nov. 13-20, 1919

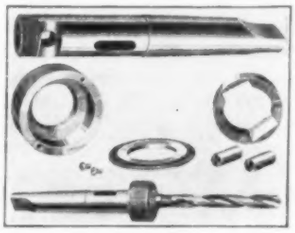


The gear is built in four sizes, with capacities ranging from 9 to 52 hp., according to size. Employs the internal gear principle, using the three-point contact system, but eliminating the central spur gear; has a balanced design. The ratio of reverse speed amounts to about 85 per cent. of the motor speed. Brake band is free to grip evenly and is supported by a bracket which surrounds the brake; being suspended, does not drag on the drum when not in use. Gear designed for shafts with diameters from $2\frac{1}{2}$ to 5 in., and the weights of the four sizes are 190, 566, 950 and 1,900 lb., respectively.

Holder, Drill, Improved

Roberts Manufacturing Co., 152-6 Brewery St., New Haven, Conn.

"American Machinist," Nov. 13-20, 1919

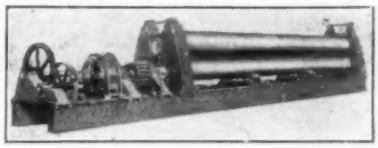


To lock the drill in place, the knurled collar is turned by hand. The loose collar, inside, is thus forced up by the screw and acts as a cam, forcing the two hardened rolls into recesses ground in the drill, holding it securely gripped and preventing it from twisting or dropping out, and incidentally preventing injury to the drill or holder.

Rolls, Bending, Heavy-Duty

Wickes Bros., Saginaw, Mich.

"American Machinist," Nov. 13-20, 1919

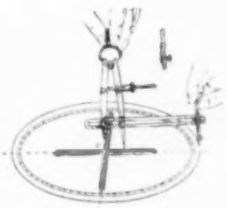


The bed is built of 24-in. I-beams and the housings are semi-steel castings. The housing at the right is hinged so that it can be opened to permit the removal of tightly rolled plates. Power is furnished by a 150-hp. motor mounted on the bed. All driving gears are steel. Distance between housings, 32 ft. 2 in.; capacity, 1-in. plate; diameter of top roll, 30 in.; diameter of bottom rolls, 20 in.; motor, 150 hp.; weight, 270,000 pounds.

Ellipsograph

Daniel C. Reid, 2717 North Crosky St., Philadelphia, Pa.

"American Machinist," Nov. 13-20, 1919



The instrument is provided with pen and pencil parts and by detaching the slotted bar it can be used as an ordinary spring divider. It is claimed that by its use all kinds of ellipses with major axes of from $1\frac{1}{2}$ to 12 in. can be drawn in one operation; also that it can be used for drawing circles up to 12 in. in diameter.

Clip, paste on 3 x 5-in. cards and file as desired

The Millholland Machine Co., Indianapolis, Ind., announces the appointment of the E. A. Kinsey Co., Cincinnati, Ohio, as agent for the Milholland turret lathes and screw machines for southern Ohio, Kentucky, Tennessee, western West Virginia and the greater part of the State of Indiana.

The International Oxygen Co., with main offices at Newark, N. J., is establishing a new branch plant at Toledo, Ohio, to furnish oxygen and hydrogen for all purposes to manufacturers and industries in that industrial section using either one or both of these gases in their processes. The capacity of the plant will be 3,000,000 cu.ft. of gas per month.

The Lombard Iron Works, Augusta, Ga., which during the machinist strike disposed of a great amount of its machinery, is reorganizing its machine shop and is purchasing lathes, drilling machines and other equipment. Previous to the strike this firm employed 300 machinists, but at present only about sixty are employed. John S. Van Pelt is the master mechanic.

Don F. Kennedy, manufacturers' agent, 1257 David Whitney Building, Detroit, who has handled the account of the Hammond Steel Co., Inc., for the past four years as district sales manager, announces the discontinuance of this line. He will, however, continue in the tool and alloy steel business. Mr. Kennedy has taken on the sales of the products of the Towmotor Co., Cleveland, manufacturer of gasoline industrial tractors for mill and factory use, for Michigan and the city of Toledo.

The National Steel Products Co., Dayton, Ohio, has been incorporated for the purpose of taking over the combined plants and assets of the National Vacuum Machinery Co., and the Crown Hardware Manufacturing Co. The company will specialize in the manufacture of the "Ream" universal joint, steel specialties, tools and dies. It will also continue the manufacture of Crown plating machinery and accessories. The officers of the company are: J. G. Petosky, president; T. M. Heister, vice president and general manager; Jos. G. Lehman, secretary and treasurer.

Personals

H. W. JACKSON has been promoted to factory manager of the S.K.F. Industries, New York City.

C. M. ROBERTSON has been elected vice president of the Dale-Brewster Machinery Co. Mr. Robertson was the Chicago manager for this company.

M. L. HUTCHINSON has been made assistant to A. H. RAINEY in the sales department of the Graton & Knight Manufacturing Co., Worcester, Mass., manufacturer of leather belting, etc.

H. C. BARNES has joined the Allegheny Gear Works, Pittsburgh, Pa., as superintendent of laboratory and metallurgical work.

LAWRENCE A. MILLER, formerly of the Ward & Hill Co., 1 Madison Ave., New York, has become associated as sales manager with the Badger Tool Co., Beloit, Wis.

IRVING H. JONES has become associated with the machinery department of the Joseph T. Ryerson & Sons and will be engaged in sales engineering work in machine-tool equipment.

SAMUEL R. DODGE, formerly chief tool designer for the Locomobile Co., has resigned to become associated with the E. A. Harper Tool and Supply Co., 30 Church St., New York City, as its Connecticut representative.

J. P. GREGG and CARLISLE ELLIS, of the Hart-Parr Co., Charles City, Iowa, have sailed for Europe where they will remain for six months to look after the interests of the Hart-Parr tractors. Mr. Gregg is attorney for the company.

THOMAS J. SCOTT, for many years plant superintendent of the Alvey-Ferguson Co., Cincinnati, Ohio, has resigned to assume the general management of the Scott-Spencer Automatic Tool Inc., of which he is president.

E. W. BERNARD, formerly of Providence, R. I. and for a number of years connected with the Hess-Bright Manufacturing Co., Philadelphia, Pa., has been made assistant to the general factory manager of the S.K.F. Industries, New York City.

FREDERICK H. PAYNE has succeeded Frank O. Wells as president of the Greenfield Tap and Die Corporation, Greenfield, Mass. Mr. Wells has disposed of his interests but will remain with the company in an advisory capacity.

HERBERT L. TENNEY has been appointed chief engineer for the Carlyle Johnson Machine Co., Manchester, Conn., to succeed J. H. ROBERTS who has accepted a position with the sales force. Mr. Tenney has been engineer for this concern for the past year.

I. F. BAKER of the Westinghouse Electric International Co., who has been located in the New York office of that company for the past two years, is now on his way to Tokio, Japan, where he will act as a special representative of the Westinghouse International Company.

WILLIAM S. STUBBS, formerly sales manager, and C. K. OLBERG, formerly vice president and secretary, are no longer connected with the International Metal Manufacturing Co., Philadelphia, Pa. JOHN A. CALL, president, has assumed the general sales management, and C. W. WYLAM, the production management.

J. GEO. LEYNER has resigned as president of the J. Geo. Lyner Engineering Works Co., Littleton, Col. Mr. Leyner resigned in order to devote all his time to the Leyner Tractor and Manufacturing Co., organized for the manufacture and sales of the Linapede tractor, which he has recently perfected. The office of the company is located at 212 Tramway Building, Denver, Col.

ELLIOTT A. ALLEN, for eight years sales engineer for the S.K.F. Ball Bearing Co. and recently district manager for this company, has organized the Allen Spindle Corporation and will manufacture ball-bearing textile spindles. This corporation has leased a plant and has installed additional machinery. The headquarters of the corporation are located in the Little Building, Boylston St., Boston, Mass.

Obituary

DANIEL F. VILES, president of the Waltham Screw Co., Waltham, Mass., died at his home in Waltham, on Dec. 24, after a brief illness.

W. H. H. WOOSTER, president of the Seymour Manufacturing Co., Seymour, Conn., died last week at the St. Raphael's Hospital, New Haven, Conn., after a short illness. Mr. Wooster served as State Senator in 1905-6.

WALDEMAR GIERTSEN, president and owner of the Chicago Machinery Exchange, died at his home in Chicago, Jan. 12, 1920, after a long illness. In addition to his business activities, Mr. Giertsen was a member of the Illinois Athletic, Hamilton, Columbia Yacht, Evanston Golf, and Chicago Norwegian Clubs.

Forthcoming Meetings

The American Institute of Mining and Metallurgical Engineers will hold its annual meeting in New York City, Feb. 16 to 19 inclusive.

The First Annual Convention of the A. S. M. I. and the Mechanical Inspection Equipment Exhibition will be held at the Hotel Astor, New York, Feb. 2 to 6 inclusive.

Boston Branch, National Metal Trades Association. Monthly meeting on first Wednesday of each month, alternating with the Employers' Association of eastern Massachusetts. George D. Berry, secretary, room 50-51, 166 Devonshire St., Boston, Mass.

Engineers' Club of Philadelphia. Regular meeting the third Tuesday of the month. Lewis H. Kenney is the chairman of committee on papers.

Electric Hoist Manufacturers' Association. Monthly meeting at the offices of the Yale & Towne Manufacturing Co., 9 East 40th St., New York City. Secretary W. C. Briggs, Shepard Electric Crane and Hoist Co.

Engineers Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Pa.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45, North Philadelphia, Pa.

Rochester Society of Technical Draftsmen. Monthly meeting last Thursday. O. L. Angevine, Jr., secretary, 547 Arnett Boulevard, Rochester, N. Y.

The Second Annual Aëronautical Exposition of the Manufacturers Aircraft Association, Inc., will be held at the Seventy-first Regiment Armory, 34th St. and Park Ave., New York, on Mar. 6-13, 1920. S. S. Bradley, 401 Fifth Ave., New York City, is the general manager.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Chuck, Roberts Improved Friction

Roberts Manufacturing Co., 152-6 Brewery St., New Haven, Conn.

"American Machinist," Nov. 13-20, 1919

Chuck is well made, having no feathers or setscrews to work loose and but few working parts. It can be properly adjusted for a tap in short order. Socket for studs and taps is provided with interchangeable nuts for different sizes and the sliding collar, when lifted, permits the socket to be removed or changed while the machine is running. The driver for the sockets is arranged to fit into the recess of the drill-spindle nose. The cup is designed to furnish lubrication for all wearing parts. With each chuck is furnished a spanner wrench and three standard taper drill sockets, Nos. 1, 2 and 3; also one tap socket and one stud socket. Interchangeable nuts, from $\frac{3}{8}$ to $1\frac{1}{4}$ in. for No. 1 chuck to $1\frac{1}{4}$ to $2\frac{1}{2}$ in. for No. 2 chuck, can be furnished as desired.

Testing Machine, Rockwell Hardness

S. P. Rockwell, 122 Dickerson St., Syracuse, N. Y.

"American Machinist," Nov. 13-20, 1919

By the shifting of a weight, the test pressure can be varied to suit conditions. Application and release of the weights are controlled by a hand-operated lever at the right of the machine. Work-holding bed is arranged so that chucks designed to hold particular classes of work can be used. Testing points are made of special alloy. Maximum opening, chuck to testing point, 2 in.; depth, testing point to frame, $2\frac{1}{2}$ in.; minimum rounds possible to test, $\frac{1}{16}$ in.; minimum thickness of steel possible to test, 0.03 in.; height, 18 in.; length, 15 in.; width, 7 in.; approximate weight, $52\frac{1}{2}$ lb.

Dog, Champion Lathe

Western Tool and Manufacturing Co., Springfield, Ohio.

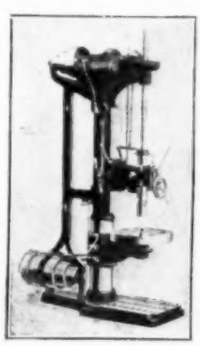
"American Machinist," Nov. 13-20, 1919

Projecting setscrews, always an element of danger, are eliminated by the recess into which the head fits. The dog is thus made safe and neat in appearance, at the same time retains the square-head setscrew. The extra metal inclosing the head also serves to balance the dog. A socket wrench is provided, making it as easy to use and as positive as the old-style dog. It is made in all standard sizes from electric furnace steel and can be furnished with straight tails as well as bent tails and with single or double setscrews for either shape

Drilling Machine, Sibley 24-Inch

Sibley Machine Co., South Bend, Ind.

"American Machinist," Nov. 13-20, 1919



Specifications: Height to top of cone pulley, 94 in.; height with spindle up, 124 in.; maximum distance, spindle to base, $52\frac{3}{4}$ in.; maximum distance, spindle to table, $25\frac{1}{4}$ in.; traverse of table on column, 13 in.; traverse of head on column, 25 in.; diameter of table, $21\frac{1}{4}$ in.; diameter of column, 8 in.; diameter of spindle, smallest, $1\frac{5}{8}$ in.; diameter of sleeve, 3 in.; feed of spindle, $10\frac{1}{4}$ in.; Morse taper hole in spindle, No. 4; spindle speeds, r.p.m., 29, 88, 116, 126, 250, 495; diameter steps on cones, $5\frac{3}{4}$ and $11\frac{5}{16}$; width of belt on cones, $3\frac{3}{4}$ in.; tight and loose pulleys, 12 x $3\frac{1}{2}$ in.; driving shaft, r.p.m., 500; horsepower, maximum, 3; working surface of baseplate, $21\frac{1}{2}$ x $20\frac{1}{2}$ in.; floor space required, 23 x 63 in.; weight (net), 1,900 lb.; weight (crated), 1,975 lb.; weight (boxed for export), 2,300 lb.; cubic contents of box, 83 cu.ft

Pump, Fire, Gas- or Electric-Driven

Lea-Courtney Co., Newark, N. J.

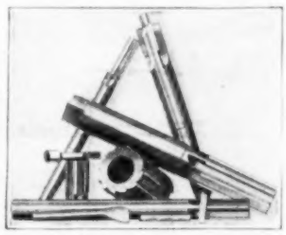
"American Machinist," Nov. 13-20, 1919

It is always desirable to have two independent sources of power for a fire pump so as to lessen the chances of its being put out of commission when a fire occurs. Sometimes neither steam nor a second source of current is available, and in that case a pump such as that shown in the illustration may be used. This pump is of 1500-gal. per minute capacity and is driven by a Westinghouse 150-hp., alternating-current motor and a 140-hp. gasoline engine.

Reamers and Counterbores, Economy

H. H. Arnold, Rockland, Mass.

"American Machinist," Nov. 13-20, 1919



High-speed blades of tapered section staked into bodies of tough but low-cost material is the principal claim for economy. Reamers were developed with the idea of producing tools requiring a minimum amount of high-price material and labor in their make-up and a consequent reduction in first cost. The adjustable feature is made by tapering the slots, so that driving the blade outward increases the diameter and maintains the cutting point at the end. This compensates for wear only. Economy counterbores have no means of adjustment; they are built up from high-speed-steel blades brazed into bodies of machinery steel. The pilots are interchangeable, ground to size and held in position by a setscrew. Three standard shanks cover the range of counterbores that are stocked in all standard sizes, from $\frac{7}{8}$ to $2\frac{5}{8}$ in. outside diameter.

Toolholder, Champion Turning

The Western Tool and Manufacturing Co., Springfield, Ohio.

"American Machinist," Nov. 13-20, 1919

A drop-forged toolholder has a wedge and cam lock for holding the cutters. The cutter is gripped its full length and as a consequence held very securely against slippage. Holder also permits use of shorter-length cutters than formerly, and, in addition, the cutter cannot be marred by the setscrew, which means that it can be readily removed from the holder. These toolholders are made in four standard sizes and in straight lengths only for the present.

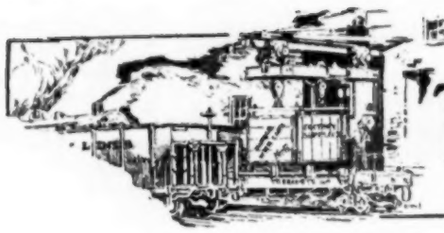
Comparator, Cylinder

Irwin & Jones, Ltd., New London Street, London, E. C.

"American Machinist" (English edition) Dec. 6, 1919

The appliance takes the form of a long, light cylinder of aluminum. At lower end are three equidistant pins, two of which are each fixed in position, being machined to suit the bore to be tested; a third pin is adjustable and pressed outward by a spring. At the top end of the sheath is a moving pointer indicator under a thick glass cover. With fixed pins in position adjustable pin is set in a standard gage until pointer is at zero. Variation from true diameter is shown on the indicator by the pointer, which moves in either direction, + or —, showing errors to 0.001 in. in the case of the instrument set to inch measure. The appliance is available in two sizes, one for bores of from 55 mm. to 125 mm. or from $2\frac{1}{4}$ in. to 5 in., while the other will test bores from 90 mm. or $3\frac{1}{2}$ in. up to 200 mm. or 8 in., the corresponding depths of bore being respectively 12 in. and 16 in.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co., as per Department of Commerce Committee Schedule.

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$39.10	$36.60
Northern Basic	38.20	34.00
Southern Ohio No. 2	40.80	36.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	45.65	39.40
Southern No. 2 (Silicon 2.25 to 2.75)	43.20	41.40
BIRMINGHAM		
No. 2 Foundry	35.50	33.00
PHILADELPHIA		
Eastern Pennsylvania No. 2	42.50*	38.10
Virginia No. 2	40.00*	39.10
Basic	40.00†	34.60
Grey Forge	39.50*	34.60
CHICAGO		
No. 2 Foundry local	40.00	36.25
No. 2 Foundry, Southern	40.50	38.00
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	39.40	.....
Basic	36.40	34.40
Bessemer	37.40	35.40

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.47	$3.47	$4.07	$3.27–2.32	$3.97	$3.47	$4.20
Soft steel bars	3.52	3.52	3.97	3.52	4.07	3.52	4.10
Soft steel bar shapes	3.52	3.52	3.97	3.57–3.82	4.07	3.52	4.10
Soft steel bands	4.22	4.22	4.57	.....	.....	.....	.....
Plates, ¼ to 1 in. thick	3.67	3.67	4.27	3.37–3.62	4.47	3.67	4.20

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$3.50	$3.50
Warehouse, New York	3.52	4.75
Warehouse, Cleveland	3.42	3.90
Warehouse, Chicago	3.52	4.10

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

	Mill Carloads, Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 28 black	$4.35–4.85	$6.50–8.00	$6.22	$6.15	$6.00
No. 26 black	4.25–4.75	6.40–7.90	6.12	6.05	5.90
Nos. 22-24 black	4.20–4.71	6.35–7.35	6.07	6.00	5.85
Nos. 18-20 black	4.15–4.65	6.30–7.30	6.02	5.95	5.80
No. 16 blue annealed	3.75–4.20	5.27	5.37	5.55	5.02
No. 14 blue annealed	3.65–4.10	5.17	5.27	5.45	4.92
No. 10 blue annealed	3.55–4.00	5.07–6.00	5.17	5.35	4.82
No. 28 galvanized	5.70–6.20	7.75–9.00	7.57	7.50	7.25
No. 26 galvanized	5.40–5.90	7.45	7.27	7.40	6.95
No. 24 galvanized	5.25–5.75	7.30	7.12	6.95	6.52

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.15	$4.90	$5.00
Flats, square and hexagons, per 100 lb. base	5.65	5.40	.....

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$21.00–26.00	$25.50
Cleveland	20.00	20.00
Chicago	16.50	16.50

In coils an advance of 50c. usually is charged.
Domestic iron (Swedish analysis) is selling at 15c. per lb.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire		Cast-Iron Welding Rods	
1, 1½, ⅞, ¾, ⅝, ½, 7/16, No. 8, 5/16 and No. 10, ¼, No. 12, 7/32, No. 14 and 1/16, No. 18, No. 20	21.00 to 30.00	5/16 by 12 in. long	14.00
		⅜ by 19 in. long	12.00
		½ by 19 in. long	10.00
		⅝ by 21 in. long	10.00
		Special Welding Wire, Coated	
		¼	33.00
		5/16	30.00
		1/16	38.00

Domestic 20c. for 1/16, 15c. for ¼ to 5/16

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.00	8.00	8.00
Spring steel (light)	8.00	10.00	11.00
Coppered bessemer rods	8.00	8.00	6.75
Hoop steel	4.47	4.75	4.32
Cold-rolled strip steel	8.40	8.25	8.60
Floor plates	6.30	6.00	6.27

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh; basing card of National Tube Co. for steel pipe, Cardry A. M. Byer's Co. for iron, both dated Mar. 21, 1919.

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
⅛, ¼ and ⅜	50½%	24%	⅛ to 1¼	30%	23½%
½	54½%	40%			
¾ to 3	57½%	44%			

LAP WELD

2	50½%	35%	2	32½%	18½%
2½ to 6	53½%	41%	2½ to 6	34½%	21½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅛, ¼ and ⅜	46½%	29%	⅛ to ½	39½%	24½%
½	51½%	39%			
¾ to 1½	55½%	43%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	48½%	37%	2	33½%	20½%
2½ to 4	51½%	40%	2½ to 4	.....	23½%
4½ to 6	50½%	39%	4½ to 6	34½%	22½%

Stock discounts in cities named are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅛ to 3 in. steel butt welded	47%	31%	43½%	34½%	57½%	44%
2½ to 6 in. steel lap welded	42%	27%	45½%	39½%	53½%	41%

Malleable fittings. Class B and C, banded, from New York stock sell at plus 22½%. Cast iron, standard sizes, net.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	19.50	19.00	20.50
Tin in 5-ton lots	63.00	55.00	72.00
Lead	9.00	7.25	5.75
Spelter	9.875	8.625	7.85
ST. LOUIS			
Lead	8.37½	6.55	7.45
Spelter	9.22½	8.10	7.50

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	29.50	33.50	29.00	31@32	31.00	36.00	32.00
Copper wire (carload lots)	29.25	29.00	28.00	29.50	32.00	27.00	28.50
Brass sheets	26.50	32.00	29.00	29.00	32.00	27.00	29.00
Brass pipe	32.00	36.00	37.00	34.00	38.00	35.00	37.00
Solder (half and half) (case lots)	39.00	45.00	41.00	40.50	44.00	38.00	39.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	23.75	26.00
New York	23.75	27.40
Cleveland	29.00	30.00
Chicago	26.00	28.50

SHOP MATERIALS AND SUPPLIES

ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill 12.00

	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.00	18.75	15.50	21.50
New York	14.00	16.00	14.50	20.25
Chicago	15.00	22.00	15.00	21.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	11.00	8.00
Chicago	11.50	8.50
Cleveland	11.75	10.625

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	— New York —		—Cleveland—		
	Current	One Year Ago	Current	One Year Ago	Chicago
Copper, heavy and crucible	18.50	16.50	18.50	17.00	17.50
Copper, heavy and wire	16.50	15.00	19.00	16.00	17.00
Copper, light and bottoms	14.50	13.00	15.50	13.00	15.75
Lead, heavy	7.25	5.25	6.50	4.00	7.25
Lead, tea	5.25	4.00	4.50	3.00	6.00
Brass, heavy	9.50	9.50	14.00	12.00	17.00
Brass, light	8.00	8.00	10.50	8.00	10.50
No. 1 yellow brass turnings	9.50	10.00	11.00	8.00	11.00
Zinc	5.00	5.00	5.00	4.00	7.00

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	33.00c.	34.00c.@35.00c.	33½c.

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	33.00	28.00
Chicago	29.00	38.00
Cleveland	32.00	33.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	87.00	74.50	80.00	70.00	75.00
Commercial	50.00	42.00	20.50	21.50	15.00	15.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	List	.80	$1.00	$1.25	$1.45	.98
Hot pressed hexagon	List	.80	1.00	1.05	1.45	.78
Cold punched hexagon	List	2.50	1.00	.75	1.05	1.00
Cold punched square	List	2.50	1.00	.75	1.05	1.00

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	70-5%	50-10%
Chicago	50%	50%
Cleveland	60-10%	50-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	30%	50%	35-5%
Larger and longer up to 1¼ in. by 30 in.	20%	40%	25-5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York ..... $1.50 Cleveland ..... $3.75 Chicago $3.00

For cast-iron washers the base price per 100 lb. is as follows:

New York ..... $7.00 Cleveland ..... $3.75 Chicago $4.25

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	25%	40-5%	30%
Larger and longer up to 1 in. by 30 in.	15%	37½%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse.:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	30%	List plus 10%	30%	List plus 10%
Chicago	10%	List price	10%	List plus 20%
New York	10%	20% from list	10%	List plus 5%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	40%	55% off	45%
Tinned	40%	55% off	45%

Boiler, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$5.00 Cleveland...$4.00 Chicago....$4.97 Pittsburgh...$4.72

Structural, same sizes:

New York...$5.10 Cleveland...$4.10 Chicago....$5.07 Pittsburgh....$4.82

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	33.50	36.00	35.00
Brass	32.00	34.00	34.00

For immediate stock shipment 3c. is usually added. The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 2c.; for lots of less than 75 lb., but not less than 50 lb., advance is 5c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 10c. should be added to base price; quantities from 10-25 lb., extra is 25c.; less than 10 lb., add 35c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in. inclusive in rounds, and ½-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

COTTON WASTE—The following prices are in cents per pound:

	NEW YORK			
	Current	One Year Ago	Cleveland	Chicago
White	13.00	11.00-13.00	14.00	11.00 to 14.00
Colored mixed	9.00 to 12.00	8.50-12.00	11.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	52.00	58.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.25	$2.25	$1.75
Philadelphia	2.00	2.00	1.75
Cleveland	2.50	2.50	2.75
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.40	$3.40	$3.65
Cleveland	4.25	4.625	4.25
Chicago	5.00	4.125	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Jan. 22	Jan. 15	Jan. 2	Dec. 24
Prompt furnace	$6.00	$6.00	$6.00	$6.00
Prompt foundry	7.00	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

	— New York —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago
Raw in barrels (5 bbl. lots)	$1.80	$1.49	$1.98	$1.66
5-gal. cans	2.00	1.74	2.23	1.86

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	14.50	16.00	13.00	14.50	14.50	13.00
25 and 50-lb. kegs	14.75	16.25	13.25	14.75	14.75	13.25
12½-lb. keg	15.00	16.50	13.50	15.00	15.00	13.50
5-lb. cans		18.00	.....	.....	16.50	15.00
1-lb. cans		19.00	.....	.....	17.50	16.00

500 lb. lots less 10% discount. 2000 lb. lots less 10-2½% discount.

Metal Working

NEW ENGLAND STATES

Conn., Windsor—The General Electric Co., Lynn, will soon award the contract for the construction of a 3 story, 67 x 200 ft. factory, here.

Mass., Newton Upper Falls—The Saco Lowell Shops, Oak St., is having plans prepared by Lockwood Greene & Co., Archts., 60 Federal St., Boston, for the construction of a 1 story foundry, for the manufacture of cotton machinery. Estimated cost, $125,000.

Mass., Roxbury—M. Nigroch, c/o F. A. Tuck, Archt., 32 School St., Boston, is having plans prepared for the construction of a 1 story, 110 x 115 ft. garage on Walnut Ave. Estimated cost, $35,000.

Mass., Springfield—The Cheney Bigelow Wire Wks., Warwick Ave., will soon award the contract for the construction of a 2 story, 71 x 195 ft. and 48 x 271 ft. factory. H. L. Sprague, 310 Main St., Archt.

Mass., Willimansett (Chicopee P. O.)—Rauch & Lang, Inc., Cleveland, O., manufacturer of automobiles, will soon award the contract for the construction of a 1 story, 80 x 300 ft. factory.

Mass., Worcester—The Curtis & Marble Machine Co., 72 Cambridge St., has awarded the contract for the construction of a 3 story, 75 x 85 ft. factory, for the manufacture of cotton machinery. Estimated cost, $45,000. Noted Jan. 15.

Mass., Worcester — The Worcester Machine Wks., 25 Bartlett St., plans to build an addition to its plant, to contain 60,000 sq.ft. floor space.

R. I., Providence—The Federal Truck Sales Co. of Rhode Island, 276 West Exchange St., will soon award the contract for the construction of a 1 story, 96 x 320 ft. service station, on Reservoir Ave. Estimated cost, $100,000. C. H. Lockwood, 171 Westminster St., Archt. Noted Jan. 1.

R. I., Providence—The Imperial Knife Co., c/o G. A. Zunner, Archt., 756 Main St., Hartford, Conn., is having plans prepared for the construction of a 2 story, 98 x 202 ft. factory, on Center St.

MIDDLE ATLANTIC STATES

Md., Baltimore — Lyon, Conkling & Co., Inc., 13-18 Balderston St., manufacturer of tins and metals, has purchased a site between McCombs and Donald Sts., South Baltimore, and plans to build a plant.

Md., Curtis Bay (Baltimore P. O.)—The Kennedy Corp., Charles and Wells Sts., chartered with $2,000,000 capital stock, plans to build a factory, for the manufacture of engine cylinders, gear cases, etc., for motor cars. J. P. Kennedy, Pres.

N. J., Bloomfield — The American La France Fire Engine Co., 250 West 54th St., New York City, has awarded the contract for the construction of a 1 story, 150 x 500 factory, here. Estimated cost, $350,000.

N. J., Elizabeth—The Simmons Co., Pearl St., Kenosha, Wis., manufacturer of beds, has awarded the contract for the construction of a factory. Estimated cost, $500,000.

N. J., Hilton (Dover P. O.)—H. Boker & Co., Inc., 101 Duane St., New York City, manufacturer of steel, hardware and cutlery, has awarded the contract for the construction of a 1 story, 55 x 70 ft. shop, a 2 story, 40 x 110 ft. store house, a 1 story, 65 x 136 ft. shop and a 3 story, 70 x 135 ft. factory, on Burnett Ave., here. Estimated cost, $300,000.

N. J., Newark—Levin & Ruderman, c/o E. V. Warren, Archt., 31 Clinton St., will soon award the contract for the construction of a 2 story, 50 x 150 ft. garage. Estimated cost, $60,000.

N. J., Trenton—The American Steel and Wire Co., Hamilton Ave., has awarded the contract for the construction of a 1 story, 60 x 100 ft. mill. Estimated cost, $25,000.

N. J., Trenton—The Star Porcelain Co., Muirhead Ave., has awarded the contract for the construction of a 2 story, 34 x 68 ft. porcelain plant. Estimated cost, $6,000.

N. Y., New York (Borough of Bronx)—J. Basheim, c/o Moore & Landseidel, Archts., 3rd Ave., and 148th St., will build a 1 story, 100 x 175 ft. garage, on Southern Blvd. and Longwood Ave. Estimated cost, $40,000.

N. Y., New York (Borough of Bronx)—Regulus Realty Co., 3295 Bway., will build a 1 story, 99 x 200 ft. garage, on 158th St. along tracks of New York Central R.R. Estimated cost, $60,000.

N. Y., New York (Borough of Brooklyn)—The B & L Contracting Co., 375 Greene Ave., will build a 1 story, 100 x 104 ft. garage, on Greene and Franklin Aves. Estimated cost, $35,000. B. W. Dorfman, 26 Court St., Archt.

N. Y., New York (Borough of Brooklyn) Berhinger Sheet Metal Wks., 315 East 97th St., has awarded the contract for the construction of a 1 story, 125 x 150 ft. factory, on Flushing and Wyckoff Aves. Estimated cost, $55,000.

N. Y., New York (Borough of Brooklyn)—S. Blum, c/o B. W. Dorfman, Archt., 26 Court St., will build a 1 story, 100 x 250 ft. garage, on Classon and Myrtle Aves. Estimated cost, $50,000.

N. Y., New York (Borough of Brooklyn)—J. H. Eckhoff, 835 Union St., will build a 1 story garage, on Bedford Ave. Estimated cost, $50,000.

N. Y., New York (Borough of Brooklyn)—The Levine Realty & Mortgage Corp., 215 Montague St., will build a 1 story, 100 x 125 ft. garage, on St. Marks and Classon Aves. Estimated cost, $35,000.

N. Y., New York (Borough of Brooklyn)—The Skalberg Realty Co., 714 Bway., will build a 2 story, 100 x 100 ft. garage, on Bedford and Park Aves. Estimated cost, $25,000.

N. Y., New York (Borough of Manhattan)—The B. & C. Mfg. Co., 294 Church St., will soon award the contract for the construction of a 5 story, factory, at 290 Church St., for the manufacture of bicycle parts and accessories. Estimated cost, $25,000. Zipkes, Wolff & Kudroff, 25 West 42nd St., Archts.

N. Y., New York (Borough of Manhattan)—Marcus & Holdstein, Inc., 175 East 96th St., will build a 1 story, 100 x 151 ft. garage, at 159 East 119th St. Estimated cost, $50,000.

N. Y., New York (Borough of Manhattan)—L. Schurmacker, 1128 Broadway, will build a 2 story, 75 x 130 ft. garage, on 1st Ave. Estimated cost, $25,000.

N. Y., Sag Harbor—The Lahy Watch Co., c/o Barney-Ahlers, Archts., 110 West 20th St., New York City, has awarded the contract for the construction of a 4 story factory. Estimated cost, $50,000.

Pa., Essington — The Westinghouse Electric Mfg. Co., Union Bank Bldg., has awarded the contract for the construction of an addition to its factory. Estimated cost, $2,000,000.

Pa., Pittsburgh—The Pittsburgh Valve Constr. Co., 26th St., has awarded the contract for the construction of a 1½ story, 27 x 84 ft. factory. Estimated cost, $70,100.

Pa., Philadelphia—W. S. Barnes, 20th and Erie Sts., maunfacturer of steel products, will build a 4 story, 100 x 300 ft. factory. Estimated cost, $200,000.

Pa., Philadelphia—J. H. Billington, 1541 North Randolph St., manufacturer of mill supplies, has awarded the contract for repairs to its 2 and 5 story factory. Estimated cost, $10,000.

Pa., Philadelphia — The Colonial Ice Cream Co., 855 North 4th St., has awarded the contract for the construction of a 3 story, 50 x 100 ft. garage, on 47th and Orianna Sts. Estimated cost, $30,000.

Pa., Philadelphia—The Franklin Process Co., 291 Promenade St., Providence, R. I., has awarded the contract for the construction of a 2 story, 75 x 103 ft. factory, for the manufacture of dye machines. Estimated cost, $45,000.

Pa., Philadelphia — A. Hartman, c/o L. Rothchild, Archt., 1225 Sansom St., will soon award the contract for the construction of a 6 story, 58 x 125 ft. sales and service station, on 16th and Vine Sts. Estimated cost, $100,000.

Pa., Philadelphia—Holland and Prettyman, Baltimore and 60th Sts., has awarded the contract for the construction of a 1 story, 18 x 100 ft., 16 x 28 ft. and 36 x 102 ft. addition to its garage. Estimated cost, $10,000.

Pa., Philadelphia—C. Kahn, Morris Bldg., will soon award the contract for the construction of a 2 story, 25 x 150 ft. addition to its sales and service station, at 1419 North Broad St. Estimated cost, $50,000. L. Rothchild, 1225 Sansom St., Archt.

Pa., Philadelphia—W. B. McCullough, c/o C. E. Oelschlager, Archt., 1615 Walnut St., plans to build a 2 story, 36 x 100 ft. service station, at 250 North Juniper St. Estimated cost, $50,000.

Pa., Philadelphia—The Quaker City Motor Parts Co., Tioga and Richmond Sts., will build a 1 and 2 story, 27 x 122 ft. and a 46 x 58 ft. garage, at 2512 North Broad St. Estimated cost, $25,000.

Pa., Philadelphia—The Universal Motor Agency, 3438 Lindlow St., will soon award the contract for the construction of a 2 story, 75 x 214 ft. automobile service station, on 34th and Chestnut Sts. Cost to exceed $50,000. P. S. Tyre, 1509 Arch St., Archt.

Pa., Scranton—The O. D. Dewitt Automobile Co., Wyoming Ave., is having plans prepared for the construction of a 2 story, 90 x 170 ft. garage. Estimated cost, $100,000.

Pa., Scranton—The Scranton Stove Wks., Jefferson and New York Sts., plans to build a 3 story, 50 x 90 ft. addition to its factory. Estimated cost, $80,000.

Pa., Scranton—H. B. Wickham, Washington St., has awarded the contract for the construction of a 2 story, 60 x 100 ft. garage, on North Main Ave. and Green Ridge St. Estimated cost, $49,700.

SOUTHERN STATES

Va., Richmond—The Laburnum Corp., 10th and Main Sts., has awarded the contract for the construction of a 2 story, 65 x 139 ft. garage, on West Broad St. Estimated cost, $50,000.

MIDDLE WEST

Ill., Chicago—The Garden City Plating and Mfg. Co., 1430 South Talman Ave., will soon award the contract for the construction of a 2 story, 80 x 140 ft. factory, at 2641 Ogden Ave. Estimated cost, $50,000. Schmidt, Garden & Martin, 104 South Michigan Ave., Archts.

Ill., Chicago—H. Kramer & Co., 1330 West 21st Pl., metal refiners, has awarded the contract for the construction of a 2 story, 60 x 65 ft. office, a 2 story, 30 x 85 ft. warehouse and a 1 story, 125 x 200 ft. foundry, on Loomis St. and 21st Pl. Estimated cost, $165,000.

Ill., Chicago—Reichel & Drews, 559 West Lake St., has awarded the contract for the construction of a 1 story, 100 x 170 ft. machine shop, at 450 North Ashland Ave. Estimated cost, $35,000.

Ill., Clearing (Chicago P. O.)—The Winchester Repeating Arms Co. has awarded the contract for the construction of a 1 and 2 story, 60 x 210 ft. factory. Estimated cost, $40,000.

Ill., Rock Island — The United States Government has awarded the contract for the construction of a 1 story, 75 x 400 ft. furnace building. Estimated cost, $150,000.

Mich., Detroit—The American Electric Heater Co., Woodward and Burroughs Sts., has awarded the contract for the construction of a 1 story, 60 x 417 ft. factory and boiler house, on Commer and Dequindre Sts. Estimated cost, $35,000.

Mich., Detroit—The Automobile Crank Shaft Corp., 192 Piquette Ave., manufacturer of automobile crank shafts, will soon award the contract for the construction of a 1 story, 40 x 166 ft. factory. Estimated cost, $20,000. D. R. Wells, 435 Woodward Ave., Archt.

Mich., Detroit — The Detroit Butcher Supply Co., Bellevue Ave., has awarded the contract for the construction of a 2 story, 84 x 200 ft. factory, on Bellevue Ave. near Mack St. Estimated cost, $50,000.

Mich., Detroit—The Detroit Grey Iron Foundry Co., Wight St., has awarded the contract for the construction of a 2 story, 135 x 150 ft. factory.

Mich., Detroit—The Houghton French Co., Mack Ave., has awarded the contract for the construction of a 2 story, 75 x 100 ft. garage and office building, on Mack Ave. and Conners Creek. Estimated cost, $45,000.

Mich., Detroit—The Liberty Investment Co., c/o M. H. Finkel, Archt., 305 Chamber of Commerce Bldg., has awarded the contract for the construction of a 1 story, 50 x 70 ft. garage, on Beaubien and Warren Sts. Estimated cost, $10,000.

Mich., Detroit—The Nash Distributing Co., Woodward Ave., has awarded the contract for the construction of a 2 story, 71 x 200 ft. garage and sales room. Estimated cost, $90,000.

Mich., Detroit—M. J. Schneider, 601 Dix Ave., has awarded the contract for the construction of a 1 story, 50 x 130 ft. battery service station and garage. Estimated cost, $25,000.

Mich., Detroit—The Timken Detroit Axle Co., Fort St., W., has awarded the contract for the construction of a 1 story, 60 x 170 ft. forge shop, on Fort and McKinstry Sts. Estimated cost, $35,000.

Mich., Detroit—The Western Gear Mfg. Co., 1040 Scotten Ave., has awarded the contract for the construction of a 1 story, 40 x 80 ft. factory, on Scotten Ave. Estimated cost, $25,000.

Mich., Flint — City Water Dept. has awarded the contract for the construction of a 1 story, 40 x 160 ft. garage, on Saginaw St. Estimated cost, $15,000.

Mich., Flint — The Independent Cold Storage Co., 120 West Kearsley St., plans to build a 3 story cold storage plant, on Industrial Ave. Estimated cost, $300,000.

Mich., Grand Rapids—Bd. Educ. plans to build a 3 story, 225 x 250 ft. junior high school, on Plainfield Ave., to include a manual arts shop. H. H. Turner, 234 Division Ave., N., Archt.

Mich., Hamtramck (Detroit P. O.)—J. W. Keister, 976 Rivard St., will soon award the contract for the construction of a 1 story, 40 x 100 ft. garage, on Conant Ave. Estimated cost, $25,000.

Mich., Kalamazoo—The Clarage Fan Co., North and Potter Sts., plans to build a 1 story, 66 x 70 ft. and 28 x 170 ft. additions to its foundry and pattern shop, on North St. Estimated cost, $100,000.

Mich., Kalamazoo—The Fuller Sons Mfg. Co., Pitcher St., manufacturer of automobile parts, has awarded the contract for the construction of a 4 story, 65 x 75 ft. transmission factory, on Pitcher and Prouty Sts. Estimated cost, $75,000.

Mich., Lansing—The Novo Engine Co., 702 Porter St., plans to build a 1 and 2 story foundry. Estimated cost, $250,000.

Mich., St. Ignace—Cunning & Mulcrone plan to build a 2 story, 24 x 60 ft. garage. Estimated cost, $75,000.

O., Cincinnati — The Rapid Electrotype Co., Canal, Race and Elm Sts., has awarded the contract for the construction of a 2 story, 100 x 215 ft. factory, on McMiken, Race and Elm Sts.

O., Cincinnati—The Witt Cornice Co., 2118 Winchell Ave., manufacturer of corrugated cans, has awarded the contract for the construction of a 1 story, 40 x 100 ft. factory.

O., Cleveland—The Automobile Rim Co., 506 Hippodrome Bldg., plans to build a 1 story, factory, on West 116th St. near Madison Ave. Estimated cost, $100,000.

O., Cleveland—The Bender Automobile Co., West 65th St. and Denison Ave., is building a 3 story, 133 x 359 ft. factory, on Barberton Ave. and West 62nd St. Estimated cost, $300,000.

O., Cleveland—The Cleveland Heater Co., 1905 West 112th St., will soon award the contract for the construction of a 1 story, 30 x 240 ft. addition to its factory, on Locust Ave. and West 112th St. Estimated cost, $100,000. G. S. Rider & Co., Century Bldg., Archts.

O., Cleveland — The Cleveland Welding Machine & Mfg. Co., West 117th St. and Berea Rd., has awarded the contract for the construction of a 1 story, 42 x 106 ft. blacksmith shop and welding room. Estimated cost, $50,000.

O., Cleveland—The Draper Mfg. Co., 3603 East 82nd St., manufacturer of steel barrels, has awarded the contract for the construction of a 1 story, 111 x 202 ft. factory, on East 82nd St. and Union Ave. Estimated cost, $75,000. Noted Jan. 15.

O., Cleveland—The Forest City Machine and Forge Co., 5101 Lakeside Ave., has awarded the contract for the construction of a 1 story, 70 x 100 ft. factory. Estimated cost, $25,000.

O., Cleveland—The Mau Sherwood Supply Co., 1616 West 3rd St., manufacturer of mill supplies, plans to build a 1 or 2 story factory, on Lima Ave. Estimated cost, $100,000.

O., Cleveland—The National Carbon Co., West 117th St. and Madison Ave., has awarded the contract for the construction of a 1 story, 120 x 180 ft. furnace building. Estimated cost, $200,000.

O., Cleveland—The Realty Syndicate Co., 309 Williamson Bldg., is having plans prepared by S. H. Weis, Archt., 1032 Schofield Bldg., for the construction of a 3 story, 116 x 250 ft. garage, on East 79th St. near Hough Ave. Estimated cost, $400,000. F. N. Riley, Secy.

O., Cleveland—The L. Sands Co., East 55th St., and Sweeney Ave., manufacturer of water heaters, will soon award the contract for the construction of a 2 story, 60 x 80 ft. factory. Estimated cost, $50,000. E. McGeorge, 1900 Euclid Ave., Archt.

O., Cleveland—The Standard Parts Co., East 11th St. and Walnut Ave., manufacturer of automobile parts, has awarded the contract for the construction of a 1 story, 167 x 168 ft. factory, at 1281 West 70th St. Estimated cost, $75,000.

O., Cleveland—The Union Sheet Metal Wks., 6908 Cedar Ave., has awarded the contract for the construction of a 1 story, 47 x 65 ft. factory, at 6515 Hough Ave. Estimated cost, $10,000.

O., Mansfield—The Roderick Lean Co., 366 Park Ave., E., manufacturer of machine tools, has awarded the contract for the construction of a 2 story, 80 x 480 ft. factory. Estimated cost, $200,000.

O., Newark—The Newark Stamping and Foundry Co. has had plans prepared by M. Peterman, Archt., 321 East Gay St., Columbus, for the construction of a 2 story, 50 x 125 ft. factory. Estimated cost, $30,000.

Wis., Milwaukee—Dolger & Kirsten, 505 Cedar St., will soon award the contract for the construction of a 1 story, 90 x 200 ft. machine shop, on 30th St. Van Ryn & De Gelleke, Caswell Bldg., Archts.

Wis., Racine—The The American Skein and Foundry Co., Lakeside, has awarded the contract for the construction of a 1 story, 100 x 230 ft. foundry. Estimated cost, $40,000.

Wis., West Allis—The Milwaukee Stamping Co., 64th and Pullen Aves., has awarded the contract for the construction of a 3 story, 80 x 140 ft. addition to its factory, on Pullen Ave. Estimated cost, $50,000.

WEST OF THE MISSISSIPPI

Ia., Cedar Rapids—The Rude Automobile Co. plans to build a 4 story, garage and office building. Estimated cost, $175,000.

Ia., Newton—The Matag Co. has awarded the contract for the construction of a 4 story, 80 x 300 ft. factory, for the manufacture of electric washing machines. Estimated cost, $250,000.

Kan., Atchison—D. Miller, 926 Santa Fe St., is having plans prepared by R. J. Kaaz, Archt., 7191 Kansas Ave., for the construction of a 2 story, 75 x 100 ft. garage. Estimated cost, $70,000.

Mo., Kansas City — J. M. Clark, 414 Dwight Bldg., has awarded the contract for the construction of a 14 story, 98 x 132 ft. garage and office building, on the corner of 11th and Cherry Sts. Estimated cost, $1,250,000.

Mo., Kansas City — Wiles & Simmons, c/o G. F. Green, Archt., 424 Rialto Bldg., will build a 3 story, 100 x 105 ft. garage and sales station, on 27th and Main Sts. Estimated cost, $75,000.

Mo., St. Louis—The Amer. Bakers Mchy. Co., 2121 North 9th St., has awarded the contract for the construction of a 100 x 210 ft. factory, for the manufacture of machinery, at 1600-26 South Kingshighway. Estimated cost, $13,000.

Mo., St. Louis—The Bayer Steam Boot Blower Co., 2828 La Salle St., has awarded the contract for the construction of a 1 story, 100 x 200 ft. machine shop at 4065 Park Ave. Estimated cost, $50,000.

Mo., St. Louis—The Burdeau Real Estate Co., 801 Chestnut St., has awarded the contract for the construction of a 1 story, 100 x 130 ft. garage and store, at 2928-36 Locust St. Estimated cost, $35,000.

Mo., St. Louis—R. Eldraher, 726 Choteau St., has awarded the contract for the construction of a 1 story, 67 x 91 ft. garage, at 1026-28 Choteau St. Estimated cost, $12,000.

Mo., St. Louis—The Emerson Electric Co., 2100 Washington St., has awarded the contract for the construction of an 8 story, 129 x 150 ft. factory, at 2012-20 Washington St. and 2011-19 St. Charles St. Estimated cost, $400,000.

Neb., McCook—The J. J. Gragg Automobile Co. is having plans prepared for the construction of a 2 story, 90 x 140 ft. garage. Estimated cost, $75,000.

Okla., Ada—W. E. Harvey is having plans prepared by C. P. Neider, Archt., Empress Theatre Bldg., Oklahoma, for the construction of a 2 story, 50 x 140 ft. garage. Estimated cost, $55,000.

WESTERN

Cal., Bakersfield—Kern Co., Union High School Dist., voted $200,000 bonds to purchase additional ground, whereon they plan the erection of a school, to include a machine shop, study hall, library and domestic science department.

Cal., Fresno—The San Joaquin Light and Power Corp., H and Tulare Sts., plans to build a 150 x 225 ft. machine shop and garage, on 1st Ave.

Cal., Los Angeles—The Keystone Iron and Steel Wks., 973 North Main St., has awarded the contract for the construction of a 2 story, 100 x 367 ft. machine shop and warehouse, on Santa Fe Ave. Estimated cost, $84,000.

Ore., Oregon City—L. Hall & Son have purchased a site on Main St. and Railroad Ave. and plans to build a 1 story, 105 x 132 ft. garage and service station. Estimated cost, $50,000.

Wash., Seattle — The Lake Union Dry Dock and Machine Wks., 1703 Westlake St., N., will build a 1 story, 40 x 80 ft. machine shop. Estimated cost, $100,000.

General Manufacturing

NEW ENGLAND

Mass., Boston—The H. L. Hildreth Co., 67 Batterymarch St., manufacturer of candy, has awarded the contract for the construction of a 2 story, 85 x 180 ft. factory addition, on Albany St. Estimated cost, $60,000.

Mass., Holyoke—The Natl. Blank Book Co., Riverside St., has awarded the contract for the construction of a 2 story, 88 x 180 ft. addition to its factory.

Mass., Monroe — The Monroe Bridge Paper Co., Monroe Bridge, has awarded the contract for the construction of a 1 story factory. Estimated cost, $25,000.

Mass., North Easton—The General Electric Co., Lynn, has awarded the contract for the construction of a 1 story, 132 x 180 ft. addition to its factory, here.

Mass., Pittsfield—The General Electric Co., Morningside, will build a 1 story, 80 x 400 ft. enameling plant.

Mass., West Medford (Boston P. O.)—The Warner & Childs Paper Co., has awarded the contract for the construction of a 4 story, 100 x 225 ft. factory, on Boston Ave., for the manufacture of corrugated paper.

Mass., Worcester — J. F. Kennedy, 6 Hitchcock Rd., plans to build a 2 story, 60 x 131 ft. factory, on James St., for the manufacture of textile goods. Estimated cost, $35,000. E. A. Chapin, 310 Main St, Archt.

N. H., North Stratford — The Warner Sugar Refining Co., 79 Wall St., New York City, plans to build a sugar refinery, here. Estimated cost, $1,000,000.

R. I., Providence—Swiss Cleansing Co., Elmwood Ave., has awarded the contract for the construction of a 2 story, 40 x 70 ft. addition to plant and a 1 story, 40 x 80 ft. shipping building. Estimated cost, $25,000.

R. I., Westerly—Lorraine Mfg. Co., 547 Mineral Springs Ave., Pawtucket, manufacture of worsted goods, will soon award the contract for the construction of a 4 story, 106 x 108 ft. mill, 1 story, 150 x 350 ft. weave shed and 1 story, 120 x 120 ft. warehouse, on Mechanic St., here. Estimated cost, $300,000. F. P. Sheldon & Sons, 1008 Hospital Trust Bldg., Providence, Engrs.

R. I., Westerly—Ninigret Mills Co., Canal St., plans to construct a 4 story, 130 x 500 ft. textile manufacturing plant. Estimated cost, $500,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—D. Garrett & Sons, 1210 Bouldin St., manufacturer of corks and barrels, has awarded the contract for the construction of a 1 story, 65 x 65 ft. garage and a 37 x 75 ft. boiler house, on East Ave. near Ellwood St. Estimated cost, $35,000.

Md., Baltimore—The Lion Bros. Co., 35-375 Poppleton St., has awarded the contract for the construction of a 2 story, 58 x 80 ft. embroidery factory, on Poppleton and Hollins Sts. Estimated cost, $50,000.

Md., Baltimore—Lucas Bros., 221 East Baltimore St., has awarded the contract for the construction of a 5 story, 30 x 104 ft. addition to its printing and bookbinding plant, on Water near Calvert St. Estimated cost, $38,000.

Md., Baltimore—The Mutual Chemical Co. of America, Block and Wills Sts., has awarded the contract for the construction of a 2 story, 100 x 200 ft. addition to its chemical plant, at 1348 Block St. Estimated cost, $60,000. J. McCracken, Supt.

N. J., Harrison—The Driver-Harris Co., c/o Lockwood Greene & Co., Archts., 101 Park Ave., New York City, manufacturer of michrone products, has awarded the contract for the construction of a 6 story, 80 x 200 ft. factory, on Middlesex St.

N. J., Hoboken—Chocolate Menier, 1127 Clinton St., has awarded the contract for the construction of a 1 story, 100 x 113 ft. addition to its factory.

N. J., Jersey City—The Air Reduction Sales Co., Pacific Ave., plans to build a 4 story factory. Estimated cost, $124,000.

N. J., Newark—The Celluloid Co., 290 Ferry St., has awarded the contract for the construction of a 3 story, 40 x 50 ft. addition to its factory, on Charles St.

N. J., Passaic—Passaic Cotton Mills, Brighton Ave., has awarded the contract for the construction of a 4 story, 100 x 700 ft. factory. Estimated cost, $750,000.

N. J., Trenton—The Puritan Rubber Co., Perrine Ave., plans to build a 1 story, 28 x 128 ft. factory. Estimated cost, $7,500. J. O. Hunt, 114 North Montgomery St., Engr.

N. J., Verona (Montclair P. O.)— The Eagle Rock Mfg. Co., is having plans prepared by Lockwood Greene & Co., Archts. and Engrs., 101 Park Ave., New York City, for the construction of a 2 story, 40 x 350 ft. factory, for the manufacture of moving picture films. Estimated cost, $250,000.

N. Y., Albany—Witherbee, Sherman & Co., 2 Rector St., New York City, will build a 1 story fertilizer plant on Westerlo Isle. Estimated cost, $1,000,000.

N. Y., Long Island City—G. W. Anderson, 221 West 17th St., manufacturers of paper boxes, has awarded the conract for the construction of a 2 story, 75 x 100 ft. factory, on Washington St. and 9th Ave. Estimated cost, $60,000.

N. Y., New York (Borough of Brooklyn)—The Ex Lax Mfg. Co., 29 De Kalb Ave., has awarded the contract for the construction of a 4 story, 50 x 100 ft. factory, at 431-433 Atlantic Ave. Estimated cost, $40,000.

N. Y., New York (Borough of Manhattan)—The Natl. Gum and Mica Co., 12 West End Ave., will soon award the contract for the construction of a 25 x 100 ft. addition to its factory.

Pa., Olyphant—The Mid Valley Silk Co. has awarded the contract for the construction of a 2 story, 51 x 152 ft. silk mill, on Main St. Estimated cost, $90,000.

Pa., Philadelphia—The Crescent Ice and Coal Co., 52nd and Woodland Sts., has awarded the contract for the construction of a 1 story, 100 x 145 ft. ice plant, on Powers Lane and Island Rd. Estimated cost, $35,000.

Pa., Scranton—The A. Brawer Silk Co., Durmore, plans to build a 2 story, 80 x 150 ft. addition to its silk mill, on Filmore Ave. and Acadamy St. Estimated cost, $60,000.

SOUTHERN STATES

N. C., Charlotte—The Elizabeth Milling Co., Realty Bldg., has awarded the contract for the construction of a flour mill. Estimated cost, $125,000.

S. C., Winnsboro—Lockwood Greene Co., 60 Federal St., Boston, is building a 3 story mill, here. Estimated cost, $3,000,000.

Tenn., Knoxville—The Sterchi Bros. Mfg. Co., 420 South Gay St., is having plans prepared by R. F. Graf, Archt., Knoxville, for the construction of a 100 x 100 ft. factory, for the manufacture of furniture. Estimated cost, $11,000.

Va., Danville—The Riverside and Dan River Cotton Mills Co., has awarded the contract for the construction of a 4 story, 133 x 800 ft. spinning mill. Estimated cost, $2,000,000.

Va., Richmond — The Simmons Co. has awarded the contract for the construction of a 2 story, 100 x 160 ft. factory, on 4th and Hull Sts., for the manufacture of mattresses. Estimated cost, $90,000.

MIDDLE WEST

Ill., Chicago — The Chicago Reedware Mfg. Co., 1523 Carroll St., is having plans prepared by Davidson & Weiss, Archts., 53 West Jackson St., for the construction of a 1 story, 200 x 350 ft. factory, on Grand Ave. and Franklin Blvd., for the manufacture of furniture. Estimated cost, $165,000.

Ill., Chicago—The Englewood Dyeing and Cleaning Co., 6343 South Halsted St., will soon award the contract for the construction of a 2 story, 100 x 100 ft. dyeing and cleaning plant, on Halsted and 76th Sts. Estimated cost, $40,000. Ludgin & Leviton, 53 West Jackson St., Archts.

Ill., Chicago—The Johnson Fare Box Co., 236 South Robey St., will soon award the contract for the construction of a 3 story, 120 x 165 ft. factory, on Ravenswood and Leland Aves. Estimated cost, $125,000. M. J. Morehouse, 343 South Dearborn St., Archt.

Ill., Chicago—The Lorette Corset Co., 510 Throop St., is having plans prepared by R. T. Newberry, Archt., 108 South La Salle St., for the construction of a 2 story, 125 x 250 ft. factory, on Crawford and Barry Aves. Estimated cost, $300,000.

Ill., Chicago—The H. O. Reno Co., 123 West Madison St., is having plans prepared by P. T. Johnstone, Archt., 1254 Pratt Bldg., for the construction of a 4 story, 125 x 150 tf. publishing plant, on Lincoln and Wrightwood Aves. Estimated cost, $225,000.

Ill., Chicago — The Standard Sash and Door Co., 5819 South Racine Ave., will soon award the contract for the construction of a 2 and 3 story, 50 x 130 ft. factory and garage, at 5813 South Racine Ave. Estimated cost, $75,000. A. G. Lund, 453 West 63rd St., Archt.

Mich., Detroit—The Detroit Baking Co., 4th St., will build a 3 story, 60 x 90 ft. addition to its bakery, on 4th and Labrosse Sts. Estimated cost, $50,000.

Mich., Detroit—The Stroh Products Co., 253 Elizabeth St., E., has awarded the contract for the construction of a 3 story, 22 x 85 ft. ice cream plant, on Hastings and East Elizabeth Sts.

O., Cincinnati—Diem & Wing, Eggleston and Lock Sts., manufacturer of paper, has awarded the contract for the construction of a 5 story, 30 x 70 ft. factory.

O., Cleveland—J. Bassiches & Son, Society of Savings Bldg., manufacturers of water bottles, are having plans prepared by A. Sharowsky, Archt., 2045 Marlowe Ave., Lakewood, for the construction of a 1 story, 40 x 120 ft. factory, on Orange Ave. and East 22nd St. Estimated cost, $25,000.

O., Cleveland—The Forbes Chocolate Co., 5100 Superior Ave., is having plans prepared by G. S. Rider & Co., Archts., Century Bldg., for the construction of a 2 story, 100 x 200 ft. factory, on Euclid Ave. and Ivanhoe Rd. Estimated cost, $250,000.

O., Cleveland — The Krause Windograd Co., Bangor Bldg., will soon award the contract for the construction of a 3 story, 40 x 65 ft. factory, at 4021 Broadway, for the manufacture of furniture. Estimated cost, $25,000. J. L. Weinberg, Bangor Bldg., Archt.

O., Cleveland—The Western Novelty Mfg. Co., 5119 Euclid Ave., manufacturer of celluloid covered buttons, is having plans prepared by Best & Hoeffler, Archts., 6532 Euclid Ave., for the construction of a 2 story, 50 x 130 ft. factory, on Cedar Ave. and East 30th St. Estimated cost, $25,000.

O., Columbus—The Columbus Dental Mfg. Co., 634 Wagner St., has awarded the contract for the construction of a 2 story, 38 x 100 ft. and 35 x 60 ft. factory, at 634 Wagner St. Estimated cost, $75,000.

O., Dayton — The Burnett Larsch Co., Monument and Webster Sts., plans to build a 5 story, 60 x 180 ft. factory, for the manufacture of pumps, etc. Estimated cost, $150,000.

O., Warren—The Goheen Mfg. Co. has awarded the contract for the construction of a 5 story, 50 x 125 ft. factory, for the manufacture of paint. Estimated cost, $200,000.

Wis., Menomonee Falls — The Farley Candy Co., 720 North Franklin St., Chicago, Ill., plans to build a 1 story, 300 x 800 ft. factory, here, for the manufacture of chocolates. Estimated cost, $300,000.

Wis., Milwaukee—The Downing Box Co., 3rd and Vienna Sts., manufacturer of paper boxes, will soon award the contract for the construction of a 1 story, 120 x 300 ft. factory. O. C. Vehling, 1st Wisconsin Natl. Bank Bldg., Archt.

Wis., Milwaukee—J. E. and E. Ulhlein, c/o Schlitz Brewing Co., 3rd St., are having plans prepared by A. W. Hoffmann, Archt., 410 Berlin Arcade, for the construction of a 1 story, 50 x 150 ft. factory, on Port Washington Rd., for the manufacture of boxes. Estimated cost, $50,000.

Wis., Milwaukee — The Westinghouse Lamp Co., 32nd and Center Sts., plans to build two 3 story 75 x 300 ft. additions to its factory.

WEST OF THE MISSISSIPPI

Ia., Cedar Rapids—The Ideal Yeast Co., 1025 South 4th St., is having plans prepared by Hatton & Holmes, Archts., for the construction of a 2 story, 70 x 100 ft. factory. Estimated cost, $60,000.

Ia., Mason City — The Webster Potter Lumber Co., Wancoca, plans to build a planing mill, here. Estimated cost, $100,000.

Kan., Elgin—The North American Refining Co. plans to build an oil refinery, here. Estimated cost, $350,000.

Kan., Wichita—The Coleman Lamp Co., 220-24 North St. Francis Ave., plans to build a 4 story, 65 x 140 ft. factory, on 2nd and St. Francis Sts. Estimated cost, $250,000.

Kan., Wichita—The Kansas Milling Co., 715 East 13th St., is having plans prepared by The Nordyke-Marmon Co., Archts., Kentucky Ave. and Morris St., Indianapolis, Ind., for the construction of a 6 story, 42 x 100 ft. mill, on 13th St. Estimated cost, $300,000.

Minn., Minneapolis—The Schurmeier Mfg. Co., 320 East 9th St., St. Paul, will soon award the contract for the construction of a 4 story, 100 x 140 ft. factory, on 5th St., N., for the manufacture of wagons. Estimated cost, $150,000. Magney & Tusler, Builders Exchange, Archts.

Mo., Kansas City—The Snower Mfg. Co., 900 Washington St., manufacturer of white duck cloth, will build a 6 story, 58 x 81 ft. factory, on 18th St. and Baltimore Ave. Estimated cost, $90,000.

Mo., St. Louis—The D. A. Blanton Co., 2nd and Spruce Sts., has awarded the contract for the construction of a 2 story, 73 x 151 ft. oleo factory, at 319-23 1st St., and 101-11 Spruce St. Estimated cost, $50,000.

Mo., St. Louis—The Burkhart Mfg. Co., 4900 North 2nd St., manufacturer of upholsterers supplies, has awarded the contract for the construction of a 1 story, 55 x 100 ft. factory, at 358 Prairie Ave. Estimated cost, $30,000.

Mo., St. Louis—Garrett & Co., Inc., 882 3rd Ave., Brooklyn, N. Y., has awarded the contract for the construction of a 2 story, 120 x 380 ft. wine factory, on Union and Brown Sts., here. Estimated cost, $700,000.

Mo., St. Louis—The Griesedieck Beverage Co., 3662 Forest Park Blvd., has awarded the contract for the construction of a 1 story, 35 x 60 ft. addition to its factory at 3654 Forest Park Blvd. Estimated cost $15,000.

Okla., Pawhuska — The Osage Mutual Oil and Refining Co. plans to build an oil refinery, in Prairie along the Midland Valley track, daily capacity, 1500 barrels. Estimated cost, $200,000.

Tex., Stephensville—The Al-Jex Refining and Holding Co. has purchased a 20 acre site, outside the city limits, and plans to build a refinery, 2500 bbl. capacity. Estimated cost, $400,000.

WESTERN STATES

Cal., Chino—The Chino Walnut Growers Association plans to build a packing house. Estimated cost, $25,000.

Cal., El Segundo—The Standard Oil Co., 200 Bush St., San Francisco, has awarded the contract for the construction of an addition and improvements to its refinery. Estimated cost, $2,000,000.

Cal., Emeryville (Oakland P. O.)—The Amer. Rubber Co., Park Ave. and Wart St., has awarded the contract for the construction of a 2 story factory and power house. Estimated cost, $100,000.

Cal., Fresno—The Richter Bottling Wks., Mono St and Broadway, is having plans prepared for the construction of a 2 story, 85 x 125 ft. plant. Estimated cost, $75,000.

Cal., Oakland—The Great Western Milling Co., 9th and Alameda Sts., Los Angeles, is having plans prepared by Strong & Scott Mfg. Co., Engrs., 413 South 3rd St., Minneapolis, Minn., for the construction of a flour mill, on the waterfront. Estimated cost, $500,000.

Cal., San Francisco—The Schmidt Lithographing Co., 2nd and Bryant Sts., has retained F. Whitton, Archt., 805 Exchange Block, to superintend the construction of a 5 story addition to its plant. Estimated cost, $228,000.

Cal., Visalia—The R. L. Hickley, 1107 Highland Ave., Los Angeles, has awarded the contract for the construction of a 2 story, 100 x 400 ft. fruit packing house and a 1 story, 50 x 60 ft. box factory, here. Estimated cost, $75,000.

Ore., Astoria—W. H. Goodnough and associates, plan to build a 2 or 3 story pulp and paper plant, to have daily capacity of 50 tons. Estimated cost, $500,000.

Ore., Hillsboro—Ray & Son, Sherlock Bldg., Portland, are having plans prepared by E. E. McClaran, Archt., Lumber Exchange Bldg., Portland, for the construction of a 2 story, 86 x 370 ft. cannery, here. Estimated cost, $60,000.

Ore., Portland—The Columbia Dairy Products Co., Vancouver, Wash., will soon award the contract for the construction of a 2 story storage plant, of 25 ton capacity, to include creamery and ice making plant. Estimated cost, $75,000.

Ore., Portland—The Oregon Casket Co., 101 North 5th St., has awarded the contract for the construction of a 1 story addition to its factory, on 21st and Savier Sts. Estimated cost, $25,000.

Ore., Portland—The Palmolive Co. plans to build a 2 story, copra mill, to have 100 ton daily capacity. Estimated cost, $30,000. C. A. Painton, Mgr.

Wash., Vader—H. A. Baldwin, Winlock, has purchased the Stillwater Lumber Co.'s site and plans to build a 1 story sawmill. Estimated cost, $7,000.

Wash., Yakima—Gibson Bros. plan to build a 5 story meat packing plant, on Yakima Ave. Estimated cost, $100,000.

CANADA

B. C., Vancouver — The Canadian Carbonate Co., 1050 Hamilton St., has awarded the contract for the construction of a 1 story, 60 x 95 ft. factory, on 11th Ave. and Yew St. Estimated cost, $70,000.

Que., Montreal—The Dominion Glass Co., 285 Beaver Hall Hill, has awarded the contract for the construction of a 3 story, 52 x 52 ft. factory, on Wellington St. Estimated cost, $25,500.

Que., Sherbrooke—The Howard Pulp and Paper Co., Montreal, has purchased a 9½ acre site, and plans to build a factory, along the bank of the St. Francis River. Estimated cost, $750,000.

Machine Tools Wanted

The following concerns are in the market for machinery and machine tools.

Conn., Bristol—The Clayton Mfg. Co., 109 Union St.—15 in. Hendey shaper and a No. 2, P. & W. die sinker.

Mass., Pittsfield—The E. D. Jones Sons Co., 25 Depot St.—Bliss straight side geared press, 2½ in. stroke, cut back frame (used).

N. J., Hoboken—The Bijur Motor Lighting Co., 15th St—motor grinder.

D. C., Washington—A. L. Flint, Purchasing Agent for the Panama Canal, Washington—miscellaneous machine tools.

N. Y., Hempstead—The Grants Main St. Garage—garage equipment.

N. Y., New York (Borough of Manhattan—The Ajax Stamping Co., 145 West 28th St.—8 No. 0, V. & O. power presses.

N. Y., New York (Bourough of Manhattan—The Rhea Co., 75 Grand St.—hydraulic presses.

Pa., Lewiston—The Belmont Motors Corp.—new equipment and machine tools.

Pa., Philadelphia—W. S. Barnes, 20th and Erie Sts.—small cranes.

Penn., Philadelphia — The Colonial Ice Cream Co., 855 North 4th St.—garage equipment.

Pa., Philadelphia — The Philadelphia Boiler Wks. Co., 1737 Filbert St.—an air compressor of 40 to 100 cu.ft. at 100 lb. air pressure, belt driven, with motor (new or used).

Pa., Philadelphia—The E. L. Porter Co., 5834 Windsor St.—14 or 16 in. lathe with 6 ft. bed.

Pa., Philadelphia — The Quaker City Motor Parts Co., Tioga and Richmond Sts.—garage equipment.

Pa., West Sunbury—The C. M. Hilliard—handle turning machine.

S. C., Winnsboro—Lockwood Greene Co., 60 Federal St., Boston—spinning machinery.

Va., Danville — The Riverside and Dan River Cotton Mills Co.—spinning machinery.

Va., Petersburg — The Virginia Normal and Industrial Institute, Ettrick St.—four 15 in. x 6 ft. back geared engine lathes, an 18 in. x 8 ft. back geared engine lathe, a crank shaper, milling machine, grinder, planer, electric portable drill, punch and shears and small shop equipment.

Ill., Dixon—The J. L. Chase Threshing Machine Co.—light geared press, similar to Consolidated or Bliss.

Ill., Peoria—The Holt Mfg. Co., West Washington St.—32 in. Lucas horizontal miller, a 22 in. Putnam lathe, 8 ft. bed, a Bath universal grinder, a 4 ft. Cincinnati Bickford radial drill, a United States electric tool grinder.

Ill., Rock Island — The United States Government—2 traveling cranes, etc.

Ill., Streator—The Anthony Co., manufacturer of Anthony Rocker Dump Bodies—a brake to take 8 gauge sheets at least 8 ft. wide, a rotary or squaring shear of similar capacity, one bolt cutter or threading machine to take ¼ in. to 1 in. and 1 Bulldozer of sufficient capacity to bend either hot or cold (preferable cold) 2½ x 2½ x ⅜ in. angle to a semicircle of a 15 in. radius. Above machines may be arranged either for motor or belt drive.

Ind., Gaston—The Gaston Machine and Tool Co.— 14 to 16 in. x 6 in. screw cutting engine lathe.

Ind., South Bend—The Oliver Plow Wks., 700 6th St.—new equipment in accordance with expansion programme.

Mich., Detroit—The Nash Distributing Co., Woodward Ave.—repair shop equipment and small tools.

Mich., Flint—City Water Dept.—repair shop equipment.

Mich., Flint — The Independent Cold Storage Co., 120 West Kearsley St.—ice machinery and refrigerating equipment.

Mich., Grand Rapids—Bd. Educ.—woodworking machinery, lathes, etc., for manual-arts shop.

Mich., Hamtramck (Detroit P. O.)—The Donge Bros., Jas. Campan Ave.—several bolt cutters.

Mich., Hamtramck (Detroit P. O.)—J. W. Keister, 976 Rivard St., machine equipment for small repair work.

Mich., Jackson — The Case Mfg. Co.—general machine tool equipment.

Mich., Jackson—The Hayes Wheel Co., South Horton St.—new equipment.

Mich., Jackson—The Sparks Withington Co., North St.—general machine tools.

Mich., Kalamazoo—The Clarage Fan Co., North and Potter Sts.—cupola and crane.

Mich., Kalamazoo—The Fuller Sons Mfg. Co., Pitcher St.—cranes and craneway.

Mich., Lansing—The Novo Engine Co., 702 Porter St.—rattler, traveler, etc.

O., Bowling Green—The Universal Machine Co.—steam hammers.

O., Cleveland—The Forbes Chocolate Co., 5100 Superior Ave.—machinery for the manufacture of chocolate.

O., Cleveland—The Standard Parts Co., 1791 East 11th St.—machinery for making metal felloes and rims.

O., Fostoria—The Fostoria Pressed Steel Co.—40 to 48 in. power squaring shear up to 10 gauge capacity.

O., Lima—The Garford Motor Truck Co., 628 Kerr St.—general machine tools.

O., Urbana—The Desmond Stephan Mfg. Co.—an automatic machine to cut glass rings from a glass tube of 30 millimeters diameter, with t thickness from 1 to 5 millimeters, and rings to be 2 millimeters wide.

Wis., Janesville—The Samson Tractor Co., 88 East Congress St.—automotive production machinery.

Wis., Milwaukee—Doelger & Kirsten 505 Cedar St—traveling crane.

Wis., Milwaukee—J. F. and E. Ulhlein, c/o Schlitz Brewing Co., 3rd St.—woodworking machinery.

Wis., Racine—The American Skein and Foundry Co., Lakeside—foundry equipment.

Wis., West Allis—The Milwaukee Stamping Co., 64th and Pullen Aves.—hardware making machinery.

Mo., St. Louis—The Bayer Steam Boot Blower Co., 2828 La Salle St.—machine shop equipment.

Mo., St. Louis—The Burdeau Real Estate Co., 801 Chestnut St.—complete equipment for automobile repair work.

Mo., St. Louis—R. Eldraher, 726 Choteau St.—complete equipment for automobile repair work.

Mo., St. Louis—Garrett & Co., Inc., 882 3rd Ave., Brooklyn, N. Y.—grape presses.

Minn., Duluth — The McDougall-Duluth Shipbuilding Co., 85th Ave., W., and Spring St.—plate bending rolls, 15 ft. between housings, (¾ in. or larger).

Minn., Minneapolis—The Central Machine Wks. Co., 1234 Central Ave.—1 or more, 3 or 4 ft. radial drills, preferably with speed box drive (new).

Neb., Norfolk—The Square Turn Tractor Co.—shaft grinder, with 12 to 18 in. swing, 60 to 66 in. between centers, and a 24 in. or larger automatic gear cutter (used).

Tex., El Paso—S. Hickle, 400 Trust Bldg.—stamping machines.

Tex., Waxahachie—The Elco Pump Co.—
One 16 in. x 8 ft. quick change gear lathe with taper attachment.
One 16 in. x 8 ft. quick change gear lathe.
1 medium size Universal milling machine.
One 20 in. stroke shaper.
1 turret lathe.
One 1¼ in. Automatic screw machine.
1 radial drill 30 to 36 in. arm.

Wash., Spokane—The Neal Bros. Grain Co.—degerminizer, barley and oat rollers, oat clippers and cleaners also steamers. Estimated cost, $50,000.

Ont., Merrilton — The Canada Pole and Shaft Co.—forging and machine tools for the manufacture of automobiles.

News of Opportunities

The latest opportunities being offered in the machinery field will be found in the

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